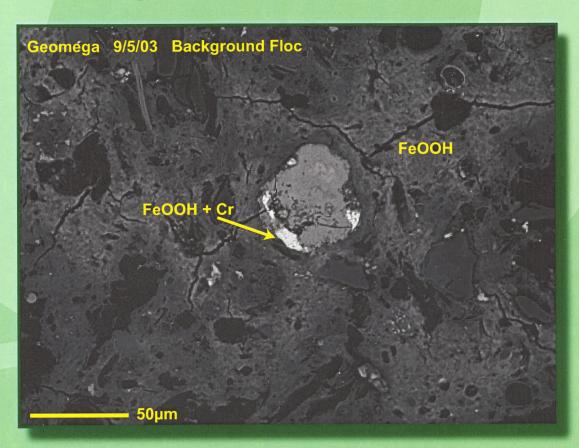
Olin Wilmington Technical Series

XXXI. Composition, Morphology, and Solubility of Flocculent in the Ditch System at the Olin Corporation Site, Wilmington, MA



Prepared for:

Olin Corporation Wilmington, MA Facility

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Composition, Morphology, and Solubility Of Flocculent in the Ditch System at the Olin Corporation Site, Wilmington, MA

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Executive Summary

Sporadic blooms of flocculent (floc) appear during the course of the year at several locations in the ditch system of the Olin Corporation Site in Wilmington, MA. The floc is described as a white to red, fluffy, low-density solid that resides on ditch streambed sediments. Three distinct floc types have been observed in the Site ditch system:

- "background floc," which occurs upgradient of the Site at the Eames Street overpass and along the entire East Ditch;
- "red floc," which is associated with the Off-Property West Ditch; and
- "white floc," which is associated primarily with the South Ditch but is also found in the East Ditch.

The present study was undertaken to (1) further quantify floc composition and describe its morphology, and (2) assess floc solubility under a range of pH conditions encompassing those that are likely to occur in the ditch system. The study serves two overlapping needs:

- it characterizes the composition and morphology of the various floc types and it quantifies the potential impacts of floc dissolution on metal concentrations in the ditch system over a range of possible pH values, and
- it augments the general characterization of floc composition by assessing the distribution of specific metals within the floc grains.

Floc and associated surface water samples were collected from three locations in the Site ditch system. Field procedures and laboratory methods are described and the analytical results are documented in an appendix. Results of study showed that:

- All floc types exhibit a botryoidal aggregate crystal habit, with individual crystallites
 generally having a radius <25µm. Some of the crystallites in the background floc also
 contain pseudoconcentric layering indicative of multi-phase precipitation. The outer
 margins of some of these grains were found to be enriched in chromium.
- The metals concentrations in background floc, red floc, and white floc are different based on total metals analysis (ICP), as would be expected from their different

appearances. Although all floc types contained relatively high levels of iron (20,200 to 89,100 mg/Kg), the highest iron concentrations were found in the white floc. White floc also had higher levels of manganese, chromium, and aluminum than either the red or background floc types.

- Electron microprobe analysis (EMPA) results varied somewhat from the analytical (ICP) results because of the different scales of analysis of the two methods. The ICP analyses are more representative of the overall bulk composition of the floc sediments, while the EMPA results provide better information regarding the composition of the individual mineral grains.
- The solubility behavior of each of the three floc types is similar, with increasing solubility as the pH drops below circum-neutral. All three floc types were observed to have low metal solubility for Fe, Al, Mn, and Cr over the range of pH conditions likely to occur in the ditch system (pH 5-7). The maximum floc-equilibrated concentrations within this range for aluminum and iron were those in equilibrium with the background floc (1.34 and 155 mg/l, respectively), and for chromium and manganese were those in equilibrium with the white floc (0.062 and 6.36 mg/l, respectively). These concentrations generally approached method detection limits as the pH approached neutral.
- Aqueous aluminum concentrations were below the normal method detection limit (0.1 mg/L) for all floc types. Low-level aluminum analyses on the white floc, which had the highest abundance of aluminum in the solid phase of all floc types, also found that aluminum concentrations were below the low-level detection limit (0.05 mg/L). Hence, geochemical modeling was used to predict Al concentrations at the Site.
- Hexavalent chromium was not detected in any of the surface water samples, any of the floc slurries, or any of the solubility study water samples (equilibrated with floc material at various pH values). There was a single anomalous detection of Cr(VI) in the white floc solid phase sample, which was analyzed using the alkaline digestion Method 3060A. However, this method is susceptible to interference when soluble trivalent Cr concentrations exceed four times the reporting limit; in the case of the

white floc solid phase sample, the concentration of Cr was significantly more than four times the 21 mg/kg reporting limit, resulting in questionable validity of the detection of Cr(VI) in this sample.

• Although analysis of the bulk composition of floc samples indicated the presence of manganese in all three floc types, Mn was not observed as a floc component when analyzed with EMPA. Based on the fact that the manganese concentrations in the floc slurries were 10 to 100 times more than the concentrations observed in the filtered water samples, it is apparent that the manganese in the ditch system is strongly partitioned into a solid phase(s).

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1 Introduction

The 51 Eames Street Property in Wilmington, MA, (the Property) is the location of a former chemical manufacturing facility that has been owned and operated by several companies since the mid-1950s. As a result of contamination from historical waste disposal practices, the Property and certain areas adjacent to it are listed by the Massachusetts Department of Environmental Protection (MADEP) as a Tier 1A Disposal Site (Release Tracking No. 3-0471). The Property is currently owned by Olin Corporation, which is responsible for response actions at the Site under the provisions of the Massachusetts Contingency Plan, 310 CMR 40.0000.

Sporadic blooms of flocculent (floc) appear during the course of the year at several locations in the ditch system surrounding and passing through the Property (Figure 1). The floc forms through the process of flocculation (i.e., the agglomeration or aggregation of suspended colloidal particles resulting in the formation of a solid-phase material), and is described in field observations as a white to red, fluffy, low-density solid that resides on ditch streambed sediments (Smith 1997). Three visually distinct floc types have been observed in the Site ditch system:

- "background floc," which occurs upgradient of the Site at the Eames Street overpass and along the entire East Ditch;
- "red floc," which is associated with the Off-Property West Ditch (OPWD); and
- "white floc," which is associated primarily with the South Ditch but is also found in the East Ditch.

When the floc is disturbed, it easily becomes suspended in the water column and is transported downstream by the current, ultimately ending up in the East Ditch.

Previous studies have detected iron, aluminum, and chromium-bearing hydroxide and sulfate phases in the floc (Smith 1997). Because of the metals detected in the floc (e.g., chromium) there is a concern of potential ecological risk to aquatic receptors in the ditch system and downstream of the East Ditch. Geochemical interactions between surface water and suspended solids and the resulting mineralogical constraints on metal concentrations in the

water column are integral components in controlling metal solubility, and consequently metal bioavailability in fluvial environments (Di Toro et al. 1990; Ankley et al. 1996, Davis and Atkins 2001). Hence, understanding of the metals content and solubility of the different floc types will assist in defining ecological risk for the ditch system.

The present study was undertaken to (1) further quantify floc composition and describe its morphology, and (2) assess floc solubility under a range of pH conditions encompassing those that are likely to occur in the ditch system. The study serves two overlapping needs:

- As described in the Scope-of-Work (SOW) for the East Ditch (letter to MADEP dated 10/11/01), it characterizes the composition and morphology of the various floc types and it quantifies the potential impacts of floc dissolution on metal concentrations in the ditch system over a range of possible pH values;
- As discussed in the SOW for the Phase III Detailed Evaluation of Remedial
 Alternatives for the Off Property West Ditch Study Area (letter to MADEP dated 10/28/02), it augments the general characterization of floc composition by assessing the distribution of specific metals within the floc grains.

In addition, spiking studies were conducted along with the solubility investigation as a means of evaluating the potential for oxidation of Cr(III) in floc to Cr(VI), which could alter the toxicological profile of floc in the ditch system.

2 Methods

2.1 Floc and Surface Water Collection

To obtain the necessary quantity of floc for these investigations, each floc type was collected at the location where it occurred in the greatest abundance (Figure 1): red floc was collected from the western spur of the Off-Property West Ditch, white floc was collected at the west end of the South Ditch approximately 20 feet downstream from the current weir, and background floc was collected from the East Ditch approximately 100 feet upgradient of the Eames Street overpass. Surface water samples were also collected at each floc sampling location and from the East Ditch near its confluence with the South Ditch; the latter sample was collected to provide site-specific surface water for the solubility study.

MACTEC performed the floc collection fieldwork in June and September 2003, and a summary of their field activities is provided in Appendix A. Because there was insufficient white floc present in June, when access to the East Ditch became available, it was necessary to collect the white floc at a later date. At the time of the fieldwork, surface water samples and splits of the floc slurry samples were sent under chain of custody directly to Severn Trent Laboratories (STL) in Westfield, MA for preliminary analysis. The remaining portions of the floc slurry samples and the additional East Ditch surface water sample were sent under chain of custody to Geomega's laboratory in Boulder, CO for use in the solubility-testing part of the study.

2.2 Laboratory Procedure

2.2.1 Compositional Analysis of Floc and Surface Water

The filtered surface water samples were analyzed by STL for dissolved chromium (total and trivalent), aluminum, iron, and manganese using EPA Method 200.7, as well as hexavalent chromium using EPA Method 7196a. The floc slurries (unfiltered floc samples in a surface water matrix) were treated as if they were unfiltered water samples and digested and analyzed for total chromium (total and trivalent), aluminum, iron, and manganese using EPA Method 200.7, hexavalent chromium using EPA Method 7196a and total suspended solids using EPA Method 160.2.

Splits of the floc samples sent to Geomega were analyzed by electron microprobe analysis (EMPA) equipped with wavelength dispersive x-ray spectroscopy (WDX). The EMPA work was performed at the University of Colorado laboratories in Boulder, CO (red and background floc) and at Hazen Research, Inc., in Golden, CO (white floc) under the supervision of Geomega personnel and following the methods described in Davis et al (1992).

2.2.2 Solubility Investigation

For the solubility investigation, suspended floc samples were centrifuged and decanted to isolate the floc. A portion of each floc type was then equilibrated with East Ditch surface water in an approximate 20:1 mass ratio of water to floc. The pH of each test batch was subsequently adjusted to the appropriate level (4, 5.5, 7.0, and 8.5 standard units) using either a 1N sulfuric acid or sodium hydroxide solution. Samples were equilibrated by mixing for 24 hours at a constant temperature typical of summer ditch-system conditions.

In one case, aliquots of the supernatant solutions were also tested at 2, 4, 8, and 16 hours to ensure that steady state conditions were achieved within the prescribed time interval (24 hours). Dissolved oxygen (DO) was monitored over the course of these batch tests to ensure that oxidizing conditions of the surface waters were reproduced in the laboratory tests. Following equilibration of the final solution sets, each sample was centrifuged and the supernatant filtered through a 0.1 µm filter. Water samples were shipped under chain-of-custody to STL in Westfield, MA for analyses of dissolved chromium (total and trivalent), aluminum, iron, and manganese using EPA Method 200.7, as well as hexavalent chromium using EPA Method 7196a. The isolated floc samples were analyzed (as a solid matrix) for chromium (total), aluminum, iron, and manganese using EPA Method 6010B, as well trivalent chromium using EPA Method 3500D and hexavalent chromium using EPA Method 7196. Geochemical parameters (pH, Eh, DO, temperature, specific conductivity) were measured on splits of all the final solutions.

To further evaluate the potential for auto-oxidation of Cr(III) to Cr(VI), aliquots from the background floc solubility test were spiked with Cr(III) to a concentration of 200 mg/L prior to equilibration of the floc and surface water. A complete set of pH tests was run with the Cr

(III) spiked samples using the methodology described above, and the samples were analyzed for the same parameters as the other floc samples.

3 Results

3.1 Morphology of Floc

The morphology of the very fine-grained floc precipitates was examined using EMPA with WDX. Photomicrographs illustrating the typical morphology of the background, red, and white flocs are shown in Figures 2, 3, and 4, respectively. All floc types exhibited a botryoidal aggregate crystal habit, with individual crystallites generally having a radius <25µm. Some of the crystallites in the background floc also contained pseudoconcentric layering indicative of multi-phase precipitation. The outer margins of some of these grains were found to be enriched in chromium.

3.2 Composition of Floc and Floc Slurries

The composition of the floc after isolation from the ambient pH groundwater and the composition of the water after equilibration with the background, red, and white floc at the pH values of interest are given in Tables 1, 2, and 3, respectively. Copies of the analytical data packages from STL are provided in Appendix B.

The metals concentrations in background floc, red floc, and white floc are different, as would be expected from their different appearances. Although all floc types contained relatively high levels of iron (20,200 to 89,100 mg/Kg), the highest iron concentrations were found in the white floc. White floc also had higher levels of manganese, chromium, and aluminum than either the red or background floc types (cf. Tables 1 through 3). A single anomalous detection of hexavalent chromium was reported in the white floc solid sample, which was analyzed using the alkaline digestion Method 3060A.

Electron microprobe results vary somewhat from the analytical results, which were based on solid phase digestion. The most significant variation is the fact that manganese was not detected in any of the floc samples using the EMPA/WDX analysis. However, EMPA did indicate the presence of sulfur in both the red and white flocs, but not in the background floc. Background floc, as observed with EMPA, is composed of iron oxide/hydroxide phases with approximately 66 wt% Fe, 2 wt% Cr, and a trace of Al <1 wt%) (Figure 2). EMPA of the red floc indicates that it is composed of an iron-chrome-aluminum sulfate phase in addition to the iron oxide/hydroxides (Figure 3). The composition of this phase is roughly 47 wt% Fe, 8

wt% Cr, 6 wt% Al, and 5 wt% S. Meanwhile, EMPA shows that the white floc contains relatively less iron (15.9 wt%), more aluminum (12.3 wt%), and minor amounts of Cr and S (2.6 wt% each). Trace amounts of Ca, Si, P, and Cl were also detected in the white floc samples.

The composition of the floc slurries (floc solid samples suspended in a surface water matrix) collected at each site are given in Table 4, and copies of the analytical data packages from STL are provided in Appendix B. Geochemical parameters measured in the field are listed on Table 5. The red and white floc slurry samples were greatly enriched in chromium (3 orders of magnitude), moderately enriched in aluminum (25 to 35 times), and had lower to similar iron and manganese concentrations relative to the background floc slurry. Hexavalent chromium was not detected in any of the floc slurry samples.

Comparison of the various analyses of floc composition (Table 6) illustrates the agreement of metal distributions in each floc type using the different analytical methods. After normalization of the results to the percentage of total metals, the different method results were generally in close agreement (within 3%), except for the results of the EMPA analyses and the ICP analyses for the red and white floc. The discrepancies between these analyses were primarily differing aluminum and iron concentrations (Mn and Cr differences were <3%). These differences were most likely due the differences of scale between analytical methods. EMPA analysis is a micro-scale analytical technique that gives compositional information on the single-grain scale, while the ICP analysis is a measurement of the bulk composition of the material and is less impacted by fine-scale compositional heterogeneities. Therefore, the ICP analyses are probably more representative of the overall bulk composition of the floc sediments, while the EMPA results provide better information regarding the individual phases present (the composition of the individual mineral grains).

3.3 Composition of Surface Water

The composition of the filtered surface water collected at each site is given in Table 4, and copies of the analytical data packages from STL are provided in Appendix B. Geochemical parameters measured in the field are listed on Table 5. Chromium and aluminum concentrations were below detection in all filtered water samples except for the red floc

sample, which had Cr and Al concentrations of 0.068 mg/L and 0.408 mg/L, respectively. The red floc filtered water sample also contained higher iron and manganese concentrations than any of the other filtered water samples (2.67 mg/L and 0.965 mg/L, respectively). The background floc water sample contained more iron than manganese (0.633 mg/L versus 0.153 mg/L), while the white floc and southeast confluence water samples contained more manganese than iron (0.582 mg/L versus 0.372 mg/L for the white floc, and 0.273 mg/L versus <0.1 mg/L for the southeast confluence). Hexavalent chromium was not detected in any of the filtered surface water samples.

3.4 Solubility of Floc

3.4.1 Background Floc

The solubility-test results for the background floc, shown on Table 1, are plotted as a function of pH in Figure 5. Geochemical parameters monitored in the lab are listed on Table 5. The results demonstrate that pH exerts a strong control on the concentration of all metals of interest, with the highest aqueous concentrations occurring at lower pH values. Chromium concentrations in equilibrium with the background floc decrease to below detection (0.01 mg/L) for pH values of 5.5 or greater. Similarly, aluminum concentrations decrease to below detection (0.1 mg/L) for pH values of 7 or greater.

3.4.2 Red Floc

The solubility-test results for the red floc, shown on Table 2, are plotted as a function of pH in Figure 6. As with the background floc, the results indicate a strong pH control. Iron remains below detection limits (0.1 mg/L) at all pH values, while aluminum, chromium, and manganese concentrations increase with decreasing pH. At circum-neutral pH, all metals except Mn (0.307 mg/L) are below detection.

3.4.3 White Floc

The solubility results for the white floc, shown on Table 3, are plotted as a function of pH in Figure 7. Again, a strong pH control is indicated. Chromium concentrations in equilibrium with white floc are higher than those in equilibrium with the two other floc types at similar pH values. White floc in equilibrium with circum-neutral pH surface water had a Cr(III)

concentration of $6 \mu g/L$ and a Mn concentration of $32\mu g/L$. Iron concentrations were below detection (50 $\mu g/L$) at all pH values greater than 4.

3.4.4 Solubility Controls

3.4.4.1 Chromium

The results of the Cr-spiked solubility test are listed on Table 1 and shown graphically in Figure 8. As with all other water samples, the samples spiked with trivalent chromium contained no detectable Cr(VI). As expected, experimental results show that chromium in floc is more soluble at low pH and less soluble at circum-neutral pH (Figure 8). Even at the lowest tested pH value (nominally 4), Cr is only fractionally soluble: background floc produced only $36 \,\mu\text{g/L}$ (Table 1), red flock produced only $399 \,\mu\text{g/L}$ (Table 2), white floc produced an average of 1,805 $\mu\text{g/L}$ (Table 3), and the background floc spiked with 200 mg/L of Cr(III) solution produced only $103 \,\text{mg/L}$ (Table 1).

3.4.4.2 Aluminum

Aluminum concentrations dropped below the normal method detection limit (100 µg/L) at circum-neutral pH. Because this limit exceeds the Ambient Water Quality Criterion (AWQC) of 87 µg/L, the geochemical model PHREEQCI (Parkhurst and Appelo, 1999) was used to estimate the aluminum concentrations likely to be present at circum-neutral pH. The geochemical model calculated Al concentrations for water similar in composition to the surface water samples in equilibrium with the aluminum hydroxide mineral gibbsite. The geochemical parameters (pH, temperature, and DO) measured for the red floc surface water sample were used as inputs to the model and aluminum concentrations in equilibrium with crystalline gibbsite were calculated to be 0.0179 mg/L, which is well below the 0.1 mg/L detection limit. As indicated by the solubility study results, aluminum concentrations tend to increase with decreasing pH. Thus, using the most acidic ditch conditions from the Site (red floc surface water sample) provided a conservative approximation of aluminum concentrations in the ditch system.

Additionally, low-level aluminum analyses (0.05 mg/L method detection limit) were requested for the white floc samples. The circum-neutral pH white floc samples were below detection, even at the lower detection limit of 0.05 mg/L (Table 3).

3.4.4.3 Iron and Manganese

Iron and manganese solubility is similar to that observed for Cr and Al, with higher concentrations observed at low pH and decreasing concentrations as pH increases. However, unlike the other metals, which were all below detection at circum-neutral pH, Mn tended to remain in solution at higher pH values. Manganese concentrations did not drop below detection limits until a pH of 8.5 for the red floc and the white floc, and remained at detectable concentrations at all tested pH values for the background floc.

3.5 Quality Control Results

In addition to the analytical laboratory quality control procedures, the use of field blanks, duplicate samples, and an examination of dissolution equilibration times were employed to further validate the study results. No metals were detected in the field blank sample, indicating that the floc field-sampling procedure did not introduce metal contaminants to samples.

The duplicate samples were compared by calculating the relative percent difference (RPD) of the samples, using the formula:

$$RPD=[X_1-X_2]/[(X_1+X_2)/2]*100$$
 (1)

where X_1 is the concentration measured in the original sample and X_2 is the concentration measured in the duplicate. Results of the duplicate analyses and the relative percent differences are listed on Table 7.

Comparison of different equilibration periods for floc solubility indicates that a 24-hour period was sufficient to attain a new steady state at the adjusted pH. Concentrations after equilibration of the red floc with surface water at pH 7.0 are shown on Figure 9 for equilibration periods of 2, 8, 16, and 24 hours.

3.6 Solubility Summary

The solubility of metals in the Olin ditch-system is relatively low. Tables 1, 2, and 3 show the relative solubility of each metal in the lab solubility tests, as well as for the field samples (floc slurries and surface water). Relative solubility is calculated using the formula:

Relative Solubility =
$$[(M_{aq}) / (M_{floc})] \times 100$$
 (2)

where M_{aq} is the mass per unit volume of the given analyte in solution (at the given pH) and M_{floc} is the mass per unit volume of the given analyte present in the floc (at the given pH). Although direct comparison is hindered by differences in pH and floc:water ratios between the lab and the field samples, relative solubility results are generally in close agreement.

Metal solubility is relatively low in the pH range likely to occur in the ditch system (pH 5-7). The maximum floc-equilibrated concentrations within this range for aluminum and iron were those in equilibrium with the background floc (1.34 and 155 mg/l respectively), and for chromium and manganese were those in equilibrium with the white floc (0.062 and 6.36 mg/l respectively). These concentrations generally approach method detection limits as the pH approaches neutral.

4 Discussion

4.1 Aluminum

While aluminum concentrations were below the method detection limit (0.1 mg/L), geochemical modeling enabled prediction of Al concentrations likely to exist at the Site. The model results showed that a conservative estimate of aluminum concentration in the Olin ditch system is 0.0179 mg/L at a pH of 5.38. Low-level aluminum analyses on the white floc, which had the highest abundance of aluminum in the solid phase of all floc types (cf. Tables 1 through 3), also found that aluminum concentrations were below the low-level detection limit of 0.05 mg/L.

4.2 Chromium

Hexavalent chromium was not detected in any of the surface water samples, any of the floc slurries, or any of the solubility study water samples (equilibrated with floc material at various pH values). There was a single anomalous detection of Cr(VI) in the white floc solid phase floc sample analyzed using the alkaline digestion Method 3060A. This method is susceptible to interference (due to laboratory induced oxidation of Cr(III)) when soluble trivalent Cr concentrations exceed four times the reporting limit (21 mg/kg in this case), as well as in the presence of "freshly precipitated Cr(OH)₃" (USEPA 1996; Ricardi 2003). The concentration of Cr in this sample was significantly more than four times the 21 mg/kg reporting limit, resulting in questionable validity of the detection of Cr(VI) in this sample. Additionally, Cr(VI) solid phases have higher solubility than the Cr(III) solid phases (Drever 1997), and as a result water in equilibrium with solid phases containing Cr(VI) should contain detectable aqueous Cr(VI); none of the water samples from this study contained detectable aqueous Cr(VI).

4.3 Iron

All three floc types were composed primarily of iron oxide/hydroxide minerals. Iron minerals such as these are good sorbents for metals (Dzombak and Morel 1990), and thus are expected to aid in sequestering metals throughout the ditch system.

While the general behavior of iron solubility was similar across the floc types, the pH at which iron concentrations began to dramatically increase varied with the floc type. This was most likely due to varying sulfate concentrations. The presence of sulfate leads to an increase in the stability of solid iron phases at lower pH, effectively suppressing the pH at which dissolved iron (and associated metal) concentrations rise. The background floc shows increased metal solubility at higher pH values relative to both the red and white floc types, which, as indicated by EMPA, contain >100 times as much sulfur as the background floc. While iron and chromium solubility increased at a higher pH in the background floc, in the presence of sulfur concentrations typical of the Site their solubility should remain low until the pH drops below about 4, due to the formation of sulfate minerals. This behavior was observed in the solubility tests for the red and white floc, as well as in the observed surface water concentrations in equilibrium with the red and white floc. Thus, the presence of elevated sulfur concentrations at the Site helps to increase the metal attenuating capacity of iron minerals in the 3 to 6 pH range.

4.4 Manganese

Manganese solubility results, although somewhat different from those of the other metals, were not unexpected. Manganese is commonly soluble up to a pH of about 10, and the oxidation of Mn(II) to the relatively insoluble Mn(III) is usually a slow, kinetically controlled process (Hem 1981; Bricker 1965).

Although analysis of the bulk composition of floc samples indicated the presence of manganese in all three floc types, Mn was not observed as a floc component when analyzed with EMPA. It is possible that the Mn detected in the floc slurries was actually present as an independent phase, not directly associated with the iron, aluminum, and chromium oxides/oxyhydroxides. At the Mn concentrations reported from the analytical digestion (22.2 to 114 mg/kg) the floc would have been roughly 0.01% Mn by weight. At those concentrations, manganese could also have simply been below the method detection limit for WDX / EMPA analysis. Regardless, based on the fact that the manganese concentrations in the floc slurries were 10 to 100 times more than the concentrations observed in the filtered water samples, it is apparent that the manganese in the ditch system is strongly partitioned into a solid phase(s).

4.5 Redox Controls

In addition to the aforementioned pH controls, the redox potential of the environment can also influence the solubility of metals having variable oxidation states, such as chromium, iron, and manganese. If floc sediments were buried or inundated by reducing waters, the reducing conditions of their environment could lead to changes in solubility controls. Figure 10 is an Eh pH diagram illustrating the potential influence of these types of changes in the redox state of the environment on the solubility of Cr. As indicated by the diagram, at circum-neutral pH a shift toward more reducing conditions is not likely to result in significant increases in chromium solubility due to the presence of the stable solid phase Cr species (Cr(OH)₃) under those conditions. Similarly, in the presence of sulfur in reducing conditions, iron solubility is controlled by the precipitation of the solid phase pyrite and (in the presence of CO₂) manganese by the solid phase rhodochrosite.

5 Conclusions

The morphology and composition of the three types of floc observed in the OPWD are documented in this study. All three floc types are fine-grained, botryoidal iron oxide/hydroxides with differing amounts of chromium, aluminum, and manganese. These types of fine-grained iron minerals have high sorption capacities and will, therefore, aid in sequestering metals from solution. Background floc contains pseudoconcentric layering with elevated chromium concentrations in the peripheral concentric zones, while the white and red floc appear to be more homogenous with respect to the distribution of metals within the floc grains. The red floc that is found in the OPWD contains more chromium and aluminum than the background floc from the East Ditch, most likely due to active sorption and coprecipitation of these metals as the floc precipitates.

The solubility behavior of each of the three floc types is similar, with increasing solubility as the pH drops below circum-neutral. However, all three floc types were observed to have low metal solubility for Fe, Al, Mn, and Cr over the range of pH conditions likely to occur at the site. None of the floc types are believed to contain any significant Cr(VI) and no Cr(VI) was observed in any of the water samples; furthermore, no potential for auto-oxidation from Cr(III) to Cr(VI) was indicated by any of the tests. While the method detection limit for aluminum precludes direct comparison of many of the measured Al concentrations to AWQC, the use of a geochemical model enabled prediction of the like range of Al concentrations in the ditch system.

6 References

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Table 1. Results of Solubility Studies of Background Floc

		рН	Analyte										
Sample	Sample		Hex	Tri	Al	Cr	Fe	Mn					
	Туре		Cr(VI)	Cr(III)	Aluminum	Chromium	Iron	Manganese					
Water				· · -	(1	mg/L)							
Bf4		3.989	0.025 U	0.036	1.67	0.036	192	3.66					
Bf5		5.542	0.01 U	0.01 U	1.34	0.01 U	155	3.66					
Bf7		7.024	0.01 U	0.01 U	0.1 U	0.01 U	0.278	1.24					
Bf8		8.528	0.01 U	0.01 U	0.1 U	0.01 U	0.1 U	0.288					
Bf4s	Spiked ¹	4.034	0.01 U	103	2.23	103	519	16.4					
Bf5s	Spiked ¹	5.533	0.01 U	53.9	1.34	53.9	433	9.25					
Bf7s	Spiked ¹	7.01	0.01 U	1.92	0.267	1.92	156	3.4					
Bf8s	Spiked ¹	8.576	0.01 U	0.915	0.177	0.915	97.6	3.46					
Bfsws ²	QA		0.01 U	205	0.2 U	205 U	0.643	0.509					
Bfws ³	QA		0.01 U	215	0.1 U	215	0.364	0.02 U					
Floc Solids			(mg/kg)										
Backfloc			0.96 U	3.44	350	3.44	36600	114					
Relative Sol	ubility												
Bf4		3.989		21%	10%	21%	10%	64%					
Bf5		5.542		6%	8%	6%	8%	64%					
Background floc slurry 6.61				3%	1%	7%	0.04%	1%					
Bf7		7.024		6%	1%	6%	0.02%	22%					
Bf8		8.528		6%	1%	6%	0.01%	5%					

¹ Spiked samples are spiked to 200 mg/L Cr(III) solution

²Surface water sample spiked with Cr(III) solution

³Deionized water spiked with Cr(III) solution

Table 2. Results of Solubility Studies of Red Floc

				Analyte									
Sample	pН	Hours	Hex	Tri	Al	Cr	Fe	Mn					
			Cr(VI)	Cr(III)	Aluminum	Chromium	Iron	Manganese					
Water					(mg/L)		···					
Red f 4	4.021	24	0.005 U	0.399	6.47	0.399	0.1 U	0.665					
Red f 5	5.503	24	0.005 U	0.022 U	0.156	0.022	0.1 U	0.651					
Red f 7	7.026	24	0.01 U	0.01 U	0.1 U	0.01 U	0.1 U	0.307					
Red f 8	8.531	24	0.01 U	0.0079	0.153	0.01	0.1 U	0.02 U					
Red f 7 24	6.998	24	0.01 U	0.005 U	0.1 U	0.01 U	0.1 U	0.284					
Red f 716	7.041	16	0.005 U	0.014	0.1 U	0.014	0.1 U	0.217					
Red f 78	7.041	8	0.005 U	0.01 U	0.1 U	0.01 U	0.1 U	0.233					
Red f 72	7.041	2	0.005 U	0.01 U	0.1 U	0.01 U	0.1 U	0.149					
Floc Solids													
Redfloc			0.95 U	6030	15000	6030	20200	22.2					
Relative Solubility	-												
Red f 4	4.021			0.1%	0.9%	0.1%	0.01%	60%					
Red floc slurry	5.38			0.04%	0.09%	0.04%	0.51%	10%					
Red f 5	5.503			0.007%	0.02%	0.007%	0.01%	59%					
Red f 7	7.026			0.003%	0.01%	0.003%	0.01%	28%					
Red f 8	8.531			0.003%	0.02%	0.003%	0.01%	2%					

Table 3. Results of Solubility Studies of White Floc

	рН	Hours						Α	nalyte					
Sample			Hex Cr(VI)		Tri Cr(III)		Al Aluminum		Cr Chromium		Fe Iron		Mn Manganese	
Water							 -	((mg/L)					
WF3	4.063	24	0.005	U	1.43	•	19.7		1.43		3.79		5.91	
WF4	4.154	24	0.005	U	2.18		23.2		2.18		45.9		6.36	
WF5	5.462	24	0.005	U	0.06		0.348		0.062		0.05	U	5.97	
WF7	6.955	24	0.005	U	0.01	U	0.05	U	0.006		0.05	U	0.032	
WF8	7.967	24	0.005	U	0.01	U	0.05	U	0.005	U	0.05	U	0.01	U
Floc Solids								(1	mg/kg)					
White floc			2080		21700		101000		23800		89100		612	
Relative Solubility	1						.							
WF3	4.063				0.1%		0.4%	6	0.19	6	0.099	6	199	6
WF4	4.154				0.2%		0.5%	6	0.2%	6	1.09	6	219	6
WF5	5.462				0.006%		0.007%		0.005%		0.001%		20%	
White floc slurry	5.6				0.008%		0.02%		0.008%		0.08%		10%	
WF7	6.955				0.001%		0.001%		0.001%		0.001%		0.1%	
WF8	7.967				0.001%		0.001%	6	0.000%		0.001%		0.03%	

Table 4. Surface Water and Floc Slurry Chemistry

				A	nalyte						
Sample	Sample	Hex	Tri	Al	Cr	Fe	Mn				
	Туре	Cr(VI)	Cr(III)	Aluminum	Chromium	Iron	Manganese				
Water		(mg/L)									
Background	filtered	0.005 U	0.005 U	0.1 U	0.01 U	0.633	0.153				
Red	filtered	0.005 U	0.068	0.408	0.068	2.67	0.965				
White	filtered	0.005 U	0.01 U	0.1 U	0.01 U	0.372	0.582				
South East Confluence	filtered	0.005 U	0.005 U	0.1 U	0.01 U	0.1 U	0.273				
Floc Solids				1)	mg/L)						
Background	floc slurry	0.005 U	0.16	17	0.161	1630	10.5				
Red	floc slurry	0.005 U	168	445	168	526	10.7				
White	floc slurry	0.005 U	128	548	128	482	6.39				

Table 5. Surface Water and Solubility Study Geochemical Parameters

Sample	Date	рН	Temp.	S.C.	D.O.	O.R.P.		Fe	Cr(VI)	TotalVolume	FlocWeight
		S.U.	deg. C	umhos/cm	mg/L	mV		mg/L	mg/L	mL	g
Field	-					measured	corrected	· · ·			
Backfloc	6/19/03	6.61	17.4	404	7.42	62		-	-	-	-
Redfloc	6/25/03	5.38	18.7	2050	8.97	138		-	-	-	-
Soeastfloc	6/25/03	5.78	19.2	412	9.71	189		-	-	-	-
Whitefloc	9/8/03	5.6	20.3	1170	14.54	137		-	-	-	-
Lab											
Bf4	7/29/03	3.613	-	1245	5.6	310	487	192	<0.01	304.2	15.00
Bf5	7/29/03	3.675	-	1147	5.7	315	492	158	<0.01	303.7	14.99
Bf7	7/29/03	6.35	-	564	6.4	151	328	0.11	<0.01	300.3	15.00
Bf8	7/29/03	6.941	-	570	6.6	164	341	0.36	<0.01	300.6	14.99
Bf4s	7/29/03	3.463	-	2270	5.3	280	457	520	<0.01	306.7	14.98
Bf5s	7/29/03	3.716	-	1970	6	263	440	410	<0.01	304.5	15.06
Bf7s	7/29/03	4.21	-	1360	5.6	245	422	140	<0.01	300.3	15.02
Bf8s	7/29/03	4.307	-	1350	4.7	246	423	90	<0.01	300.6	15.00
Red f 4	7/23/03	6.94	-	1244	6.8	167	344	<0.01	<0.01	300.8	15.00
Red f 5	7/23/03	4.353	-	721	7.1	271	448	<0.01	<0.01	300.1	15.06
Red f 7	7/23/03	5.325	-	681	6.5	248	425	<0.01	<0.01	301.6	15.05
Red f 8	7/23/03	6.53	-	1078	11.7	213	390	<0.01	<0.01	303.8	15.00
Red f 7 24	7/23/03	7.373	-	1652	6.6	168	345	<0.01	<0.01	301.8	14.99
Red f 716	7/23/03	6.678	-	1117	9.3	203	380	<0.01	<0.01	302.0	15.40
Red f 78	7/23/03	6.718	-	1263	11.6	176	353	<0.01	<0.01	301.9	15.11
Red f 72	7/23/03	6.473	-	1186	6.8	204	381	<0.01	<0.01	302.1	15.10
WF3	10/21/03	4.564	-	2760	7.1	231	400	5	<0.01	808.4	43.48
WF4	10/21/03	4.44	-	2900	4.1	236	405	4	<0.01	809.4	41.41
WF5	10/21/03	6.039	-	2930	7.3	200	369	0.04	<0.01	803.0	40.68
WF7	10/21/03	6.948	-	3050	5.6	171	340	0.02	<0.01	800.8	41.58
WF8	10/21/03	7.632	-	3220	5.8	156	325	0.01	<0.01	803.1	40.83

Table 6. Comparison of Floc Type Compositional Analyses

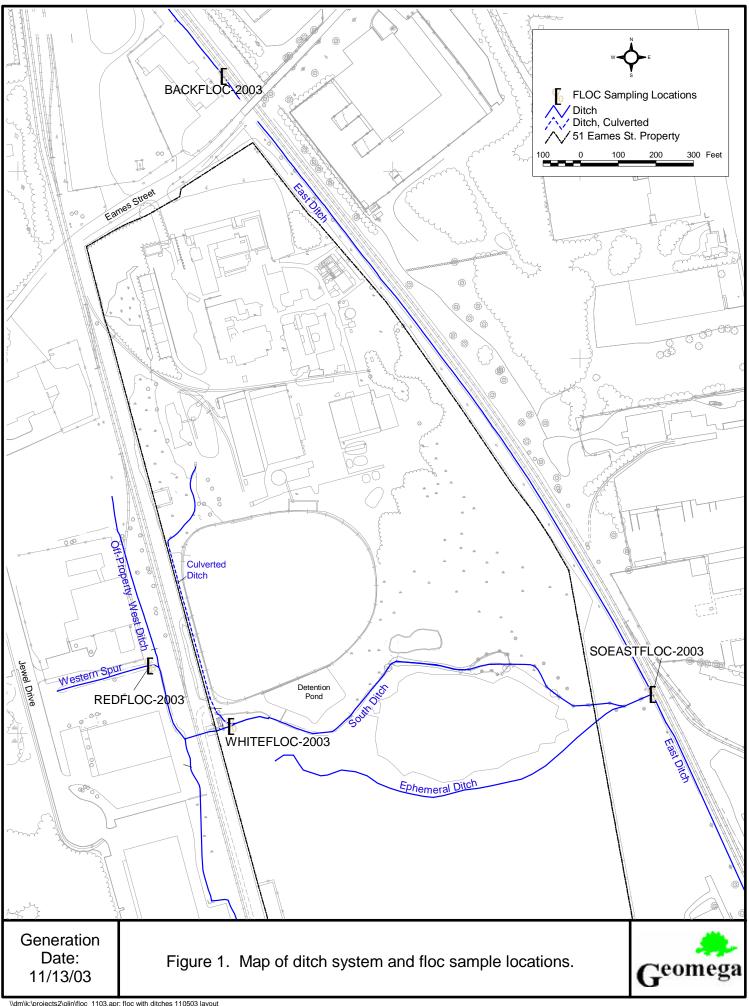
		Concentration		Conc	entration			% of Tot	ai Metais	
Floc Type	Analysis	Units	Al	Cr	Fe	Mn	AI	Cr	Fe	Mn
Background ¹	floc solid / EMPA	Wt%	0.9	2.2	66.5	ND	1%	3%	96%	ND
Red ¹	floc solid / EMPA	Wt%	5.9	8.2	47.1	ND	10%	13%	77%	ND
White ¹	floc solid / EMPA	Wt%	12.3	2.6	15.9	ND	40%	8%	52%	ND
Background	floc solid / ICP	mg/Kg	350	3.44	36600	114	1%	0%	99%	0%
Red	floc solid / ICP	mg/Kg	15000	6030	20200	22.2	36%	15%	49%	0%
White	floc solid / ICP	mg/Kg	101000	23800	89100	612	47%	11%	42%	0%
Background	floc slurry / ICP	mg/L	17	0.161	1630	10.5	1%	0%	99%	1%
Red	floc slurry / ICP	mg/L	445	168	526	10.7	39%	15%	46%	1%
White	floc slurry / ICP	mg/L	548	128	482	6.39	47%	11%	42%	1%

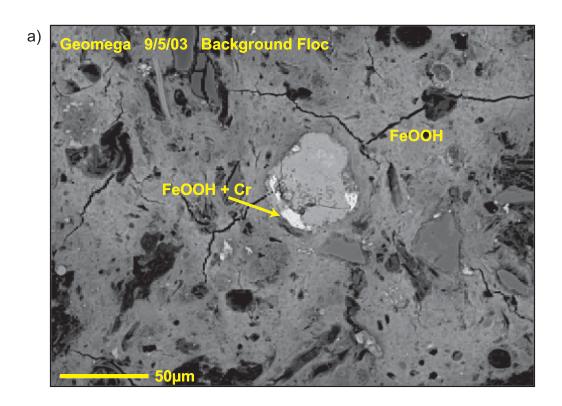
¹Concentration as atomic Wt% ND = Not Detected

Table 7. Duplicate Analyses and Relative Percent Differences

			Analyte								
Sample	pН	Hours	Hex	Tri	Al	Cr	Fe	Mn			
			Cr(VI)	Cr(III)	Aluminum	Chromium	Iron	Manganese			
Water					(mg	J/L)					
Red f 7	7.026	24	0.01 U	0.01 U	0.1 U	0.01 U	0.1 U	0.307			
Red f 7 24	6.998	24	0.01 U	0.005 U	0.1 U	0.01 U	0.1 U	0.284			
RPD*	0.4	0.0	0.0	66.7	0.0	0.0	0.0	7.8			
WF4	4.154	24	0.005 U	2.18	23.2	2.18	45.9	6.36			
WF3	4.063	24	0.005 U	1.43	19.7	1.43	3.79	5.91			
RPD*	2.2	0.0	0.0	41.6	16.3	41.6	169.5	7.3			

^{*}RPD = Relative Percent Difference (see text section 3.5 for detailed description)





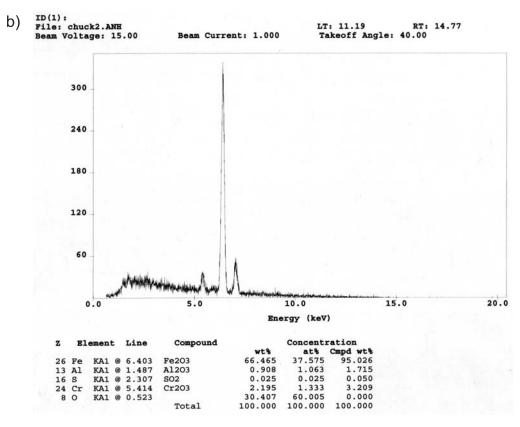
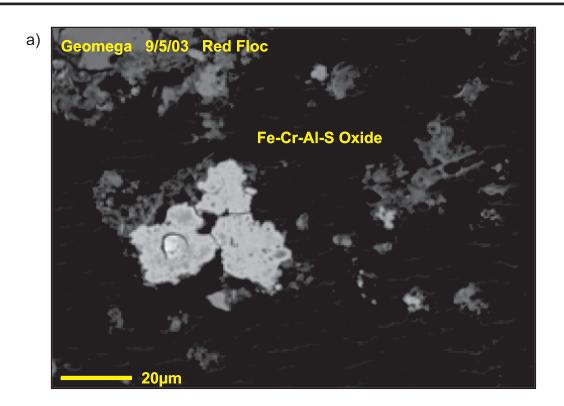


Figure 2. a) EMPA photomicrograph and b) WDX spectra of background floc.





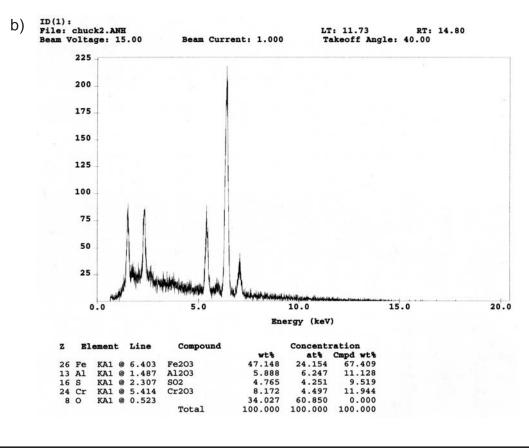


Figure 3. a) EMPA photomicrograph and b) WDX spectra of red floc.



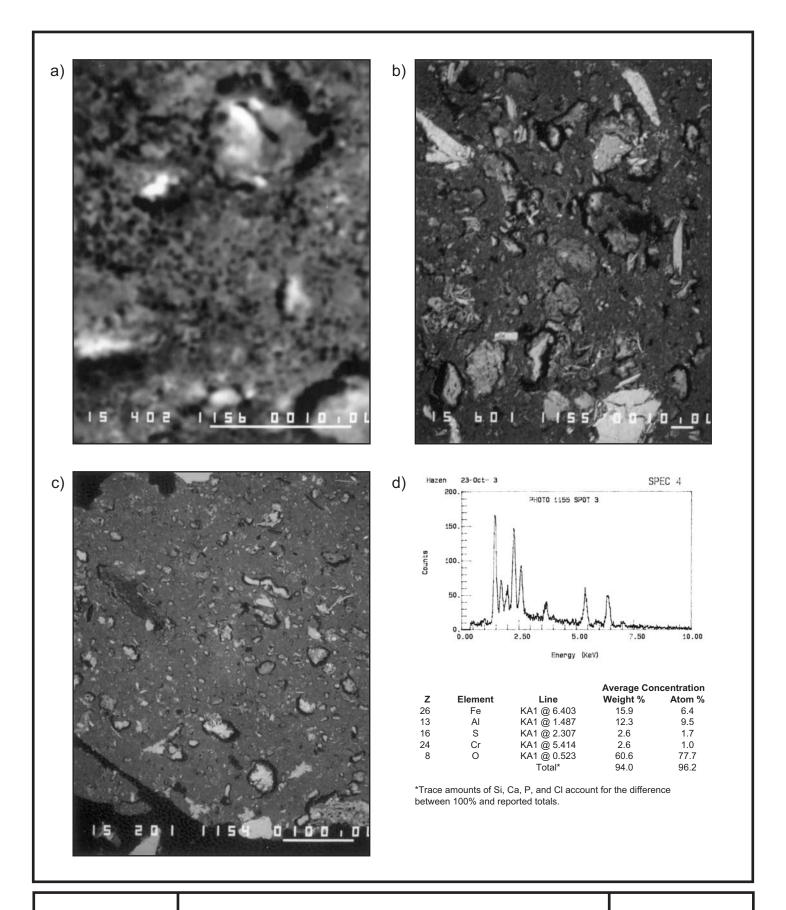


Figure 4. a), b) and c) EMPA photomicrographs and d) WDX spectra from white floc.



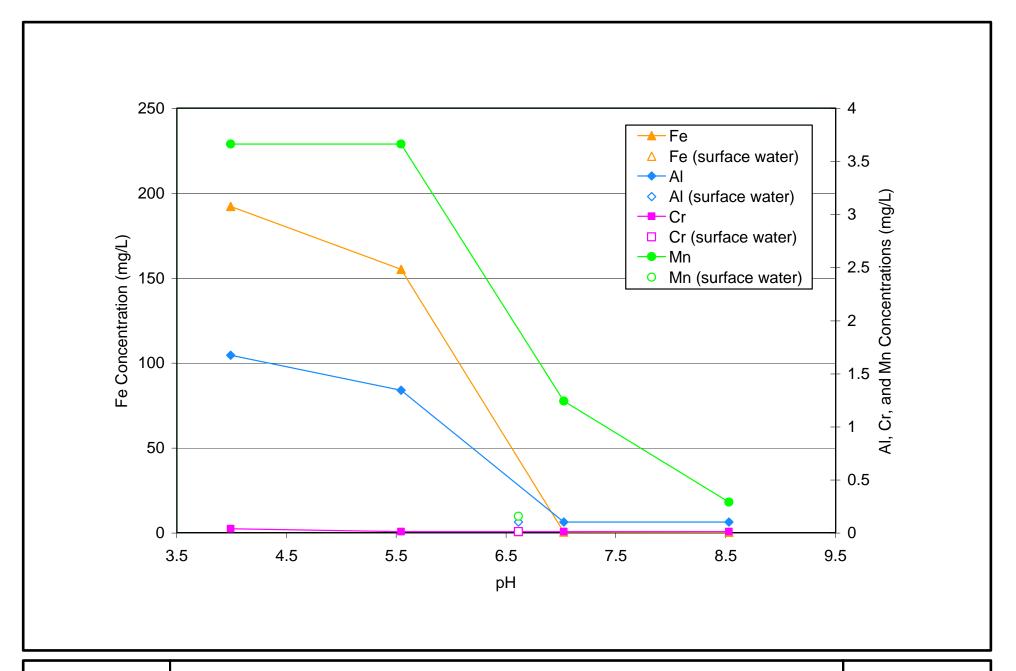


Figure 5. Metal solubility of background floc as a function of pH.



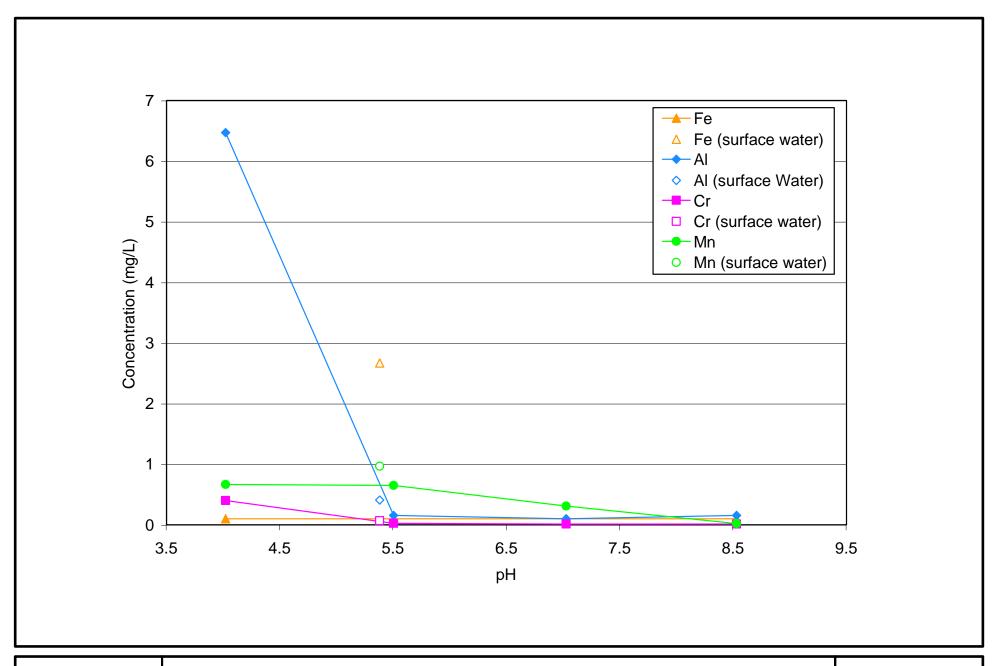


Figure 6. Metal solubility of red floc as a function of pH.



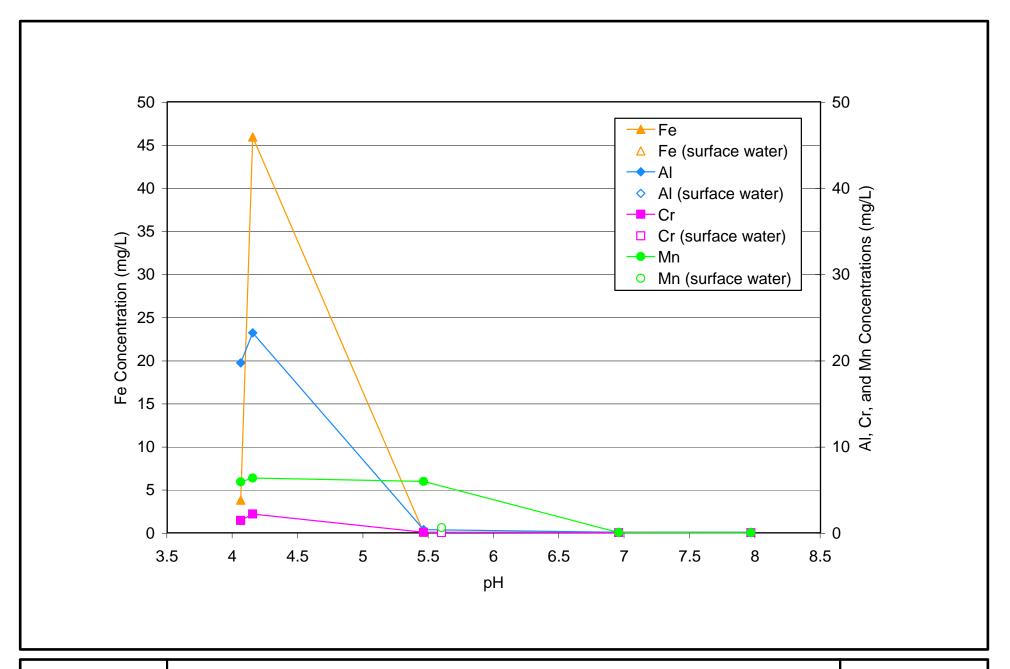


Figure 7. Metal solubility of white floc as a function of pH.



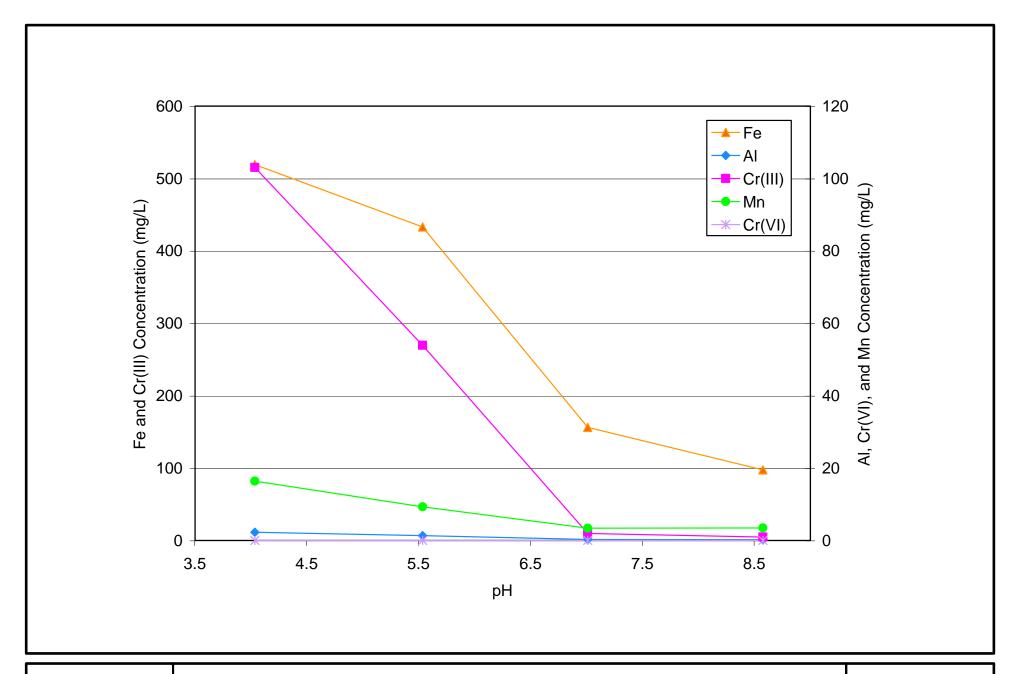


Figure 8. Metal solubility in Cr spiked samples as a function of pH .



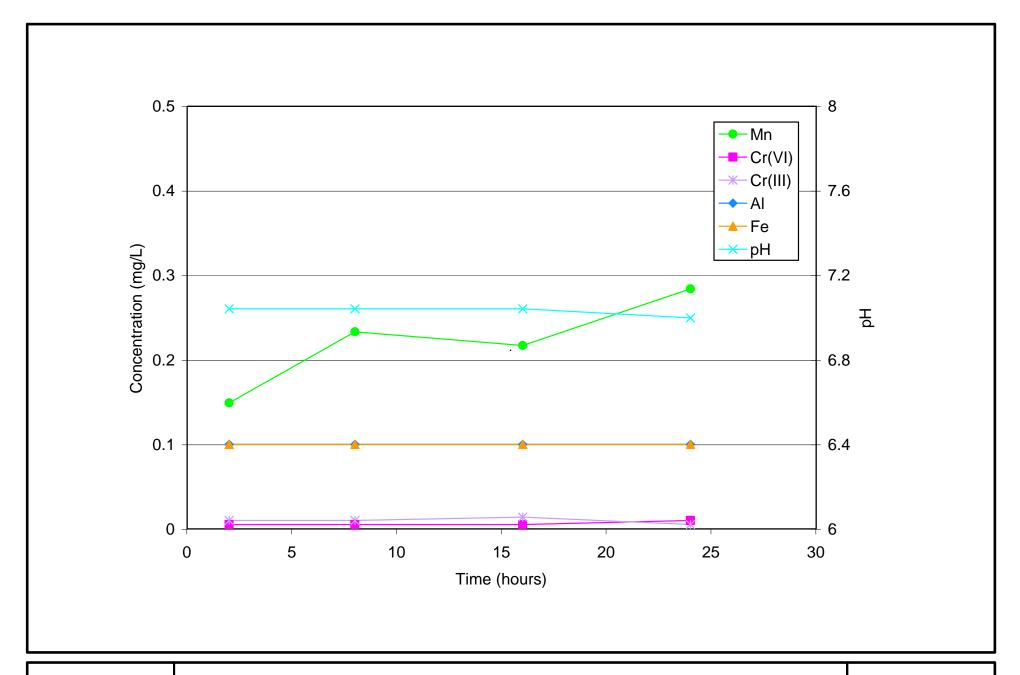


Figure 9. Graph of metal concentrations in surface water equilibrated with red floc for various periods of time



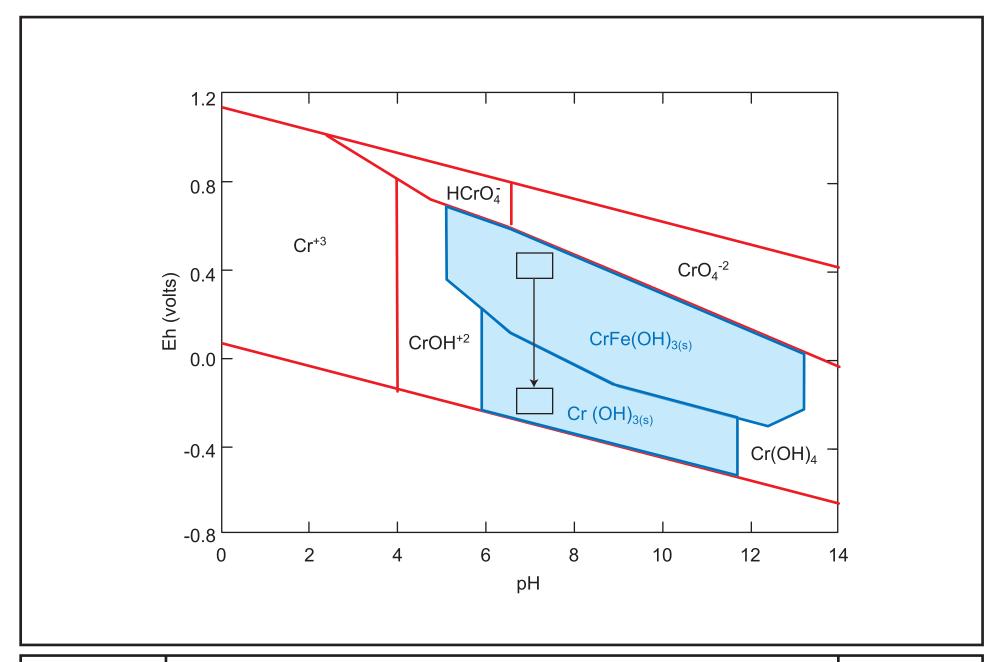


Figure 10. Eh pH diagram for chromium showing the change of stable phase under reducing conditions.





November 6, 2003

PN: 6300030008/06.12

Mr. Stephen G. Morrow, P.E. Principal Environmental Specialist Olin Corporation Lower River Road, Post Office Box 248 Charleston, Tennessee 37310

Subject: FLOC Sampling Events

Phase III ISE

Off-Property West Ditch (OPWD)

Olin Corporation

Wilmington, Massachusetts

Dear Mr. Morrow:

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to provide Olin Corporation with this report summarizing the field activities relative to the floc collection sampling executed to support the Off-Property West Ditch Feasibility Study. Floc collection activities occurred on June 19, June 25, and September 8, 2003.

Sample Collection Locations:

Floc was collected from pre-determined locations in the OPWD, the South, and the East Ditches. In Addition, surface water samples were collected from the confluence of the South and East Ditches. The "Backfloc-2003" floc and co-located "BackflocSW-2003" surface water sample were collected from the East Ditch approximately 100 feet upstream of the Eames Street Bridge. This location is situated on the west side of the Inbound Massachusetts Bay Commuter Railroad (MBCR) tracks. The location is approximately 150 feet north of the Wilmington facility.

The samples identified as Redfloc-2003 and RedflocSW-2003 (floc and filtered surface water samples) were collected from the OPWD. These samples were obtained from OPWD sampling location OPWD-SW-WS located in the western spur of the OPWD. This area is approximately 200 feet downstream, east, of the culvert marking the beginning of the OPWD (Figure 1).

Surface water samples were obtained from the confluence of the East and South Ditches. This sample was identified as "SOEASTFLOC-2003". This location was approximately 2 feet into the East Ditch.

The samples identified as "Whitefloc-2003" and "WhiteflocSW-2003", were obtained from the South Ditch below the South Ditch Weir structure. This sample of floc and surface water was obtained from the northwestern bank of the South Ditch, 10 feet downstream of the weir (Figure 1).

Mr. Stephen Morrow Olin-Corporation Floc Sampling November 6, 2003

Sample Collection Methodology:

An ISCO® peristaltic pump and dedicated polyethylene tubing were used to "vacuum" the floc from the surface of the ditch sediment. One member of the sampling team would identify the sampling location, enter the ditch below the sampling location and vacuum the floc from the ditch, while the other member of the sampling team would ensure the necessary volume of floc had been obtained. This member would then fill the required sample bottles.

The pump intake was set slightly above the floc covered substrate, in order to maximize the amount of floc entrained and limit the volume of sediment from the ditch into the sample. Samples were collected into collapsible five (5) gallon carboys. The sample was then agitated, and introduced into laboratory sample bottles, and the 2.5 gallon benchscale testing container. The benchscale testing container was then labeled, weather conditions recorded, and air was evacuated from the collapsible container. All containers were then placed on ice, prior to their preparation for shipment to the appropriate laboratory or to Geomega. All co-located surface water samples obtained for dissolved metals analysis were field filtered with dedicated 45 μ m Teflon filters, and placed into laboratory supplied glassware.

Sampling Protocol:

To obtain the necessary quantity of floc for this study, floc was collected at two locations on June 19, and June 25, 2003. Specifically, Red Floc was collected from the Off-Property West Ditch on June 25, 2003, while Background Floc was collected from the East Ditch on June 19, 2003. White Floc was collected on September 8, 2003. In addition, East Ditch surface water was collected on June 25, 2003 from PCMP Quarterly Surface Water Sampling location 1170-ISCO3, located at the confluence of the East and South Ditches. This location was identified as "SOEASTFLOC-2003." The purpose of this final collection was to provide water and water quality data for the study, which represented static in-situ conditions at the confluence of the East and South Ditches.

Prior to floc and surface water sample collection, water quality parameters (pH, specific conductivity (SC), dissolved oxygen (DO), temperature and oxidation-reduction potential (ORP)), water depth, stream velocity and weather were recorded (Table 2). Stream velocity and water depth information was obtained with a Marsh-McBirney brand digital stream velocity meter at each sampling location.

Laboratory Analysis:

Floc samples were not filtered and were analyzed by STL for the following constituents: Total chromium via SW846 method 6010B MC, Trivalent chromium via SW846 method SM18 3500D, Aluminum, iron and manganese via SW846 method 6010B, Hexavalent Chromium via SW846 method 7196/3060A, Total Suspended Solids via EPA 160.2, and Ammonia-Nitrogen via method LAC 107061B.

Mr. Stephen Morrow Olin-Corporation Floc Sampling November 6, 2003

Surface Water samples were field filtered and analyzed by STL for the following constituents: Total chromium via SW846 method 6010B MC, Trivalent chromium via SW846 method SM18 3500D, aluminum, iron and manganese via SW846 method 6010B, Hexavalent Chromium via SW846 method 7196/3060A, and Ammonia-Nitrogen via method LAC 107061B.

Quality Control:

MACTEC personnel performed the sampling work in general accordance with the approved Quality Assurance Project Plan (QAPP), dated August 1999.

All samples were collected, labeled, preserved, and placed on ice prior to shipment, under chain of custody protocol, for analytical testing. All shipments were received by the appropriate laboratory.

Please do not hesitate to contact Eric Axelrod or Jason Naiden at (781) 245-6606 if you have any questions.

Sincerely,

MACTEG Engineering and Consulting, Inc.

Jason Naiden
Staff Scientist

Eric Axelrod, DSP Project Manager

Attachments:

Figure 1. Floc Sampling Off-Property West Ditch and South Ditch

Table 1. FLOC Sampling

Table 2. FLOC Sampling - Water Quality Parameters

cc:

Margret Hanley, LSP, SHD

Dan Stone, Geomega

Project File [p:\w5\olin\wilmington/Floc\Revised11-03FinalFlocSampLetter.doc]

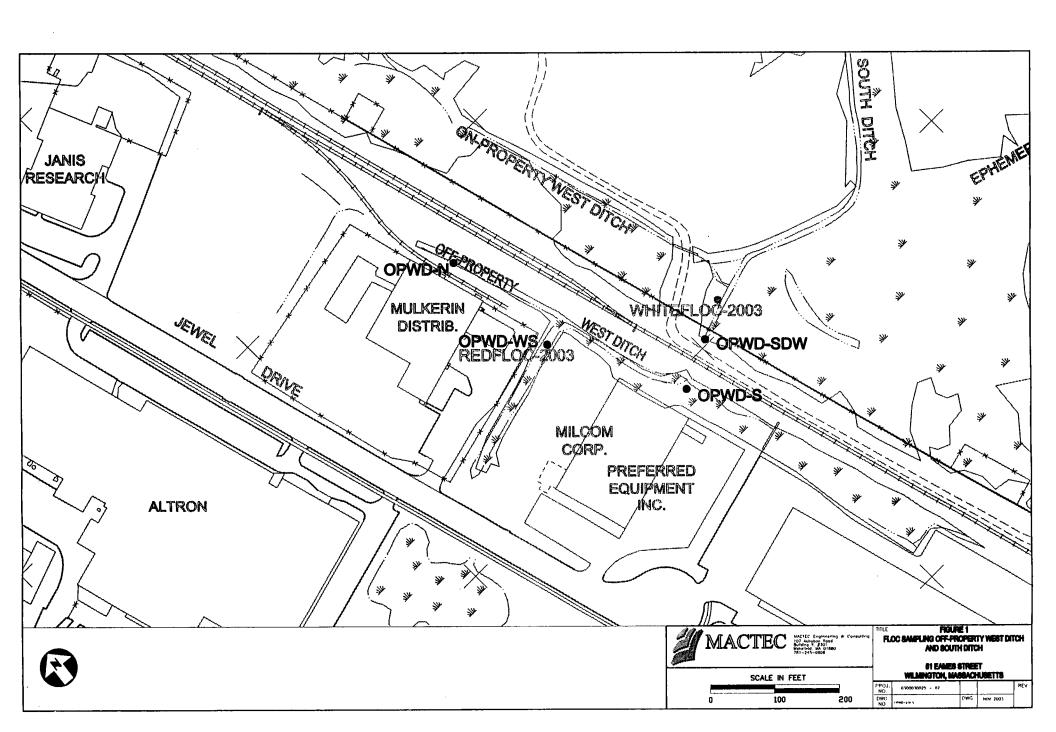


Table 1 FLOC Sampling Olin-Wilmington November 3, 2003

(The following table is based on information provided by Geomega)

Sample Type	Volume	Preservative	Analysis
	2.5 gallon	None	Floc Dissolution Study -and EMPA as part of PIII for OPWD
			*Dissolved Metals (total
OPWD FLOC - (Not Filtered)			chromium, trivalent chromium,
,	500 ml	Acid	alluminum, iron, manganese)
	250 ml	H2SO4	Ammonia
	250 ml	NaOH	Hexavalent Chromium
	1 L	None	TSS
	lo fllos	None	Floc Dissolution Study -
	2.5 gallon	None	*Dissolved Metals (total
			chromium, trivalent chromium,
South Ditch FLOC - (Not	F00!	Acid	alluminum, iron, manganese)
Filtered)	500 ml	H2SO4	Ammonia
ŕ	250 ml	NaOH	Hexavalent Chromium
	250 ml	None	TSS
<u></u>	1 C	None	100
	2.5 gallon	None	Floc Dissolution Study
			*Dissolved Metals (total
			chromium, trivalent chromium,
East Ditch Background	500 ml	Acid	alluminum, iron, manganese)
FLOC - (Not Filtered)	250 ml	H2SO4	Ammonia
	250 ml	NaOH	Hexavalent Chromium
	1 L	None	TSS
<u> </u>	т —		Temp, pH, DO, SC
			*Dissolved Metals (total
•			chromium, trivalent chromium,
OPWD Surface Water -	5001	Acid	alluminum, iron, manganese)
(Filtered)	500 ml	H2SO4	Ammonia
, ,	250 ml	NaOH	Hexavalent Chromium
	250 ml	NaOii	Hexavalent Chronilan
	1		
			Temp, pH, DO, SC
			*Dissolved Metals (total
South Ditch Surface Water -	1		chromium, trivalent chromium,
(Filtered)	500 mi	Acid	alluminum, iron, manganese)
(i iireiea)	250 ml	H2SO4	Ammonia
	250 ml	NaOH	Hexavalent Chromium
	<u> </u>		
			Temp, pH, DO, SC
			*Dissolved Metals (total
Fact Ditab Confess Mater			chromium, trivalent chromium,
East Ditch Surface Water -	500 ml	Acid	alluminum, iron, manganese)
(Filtered)	250 ml	H2SO4	Ammonia

	250 ml	NaOH	Hexavalent Chromium
	<u> </u>		
-			Temp, pH, DO, SC
			*Dissolved Metals (total
0 0 15 15 1			chromium, trivalent chromium,
Confluence of East Ditch and	500 ml	Acid	alluminum, iron, manganese)
South Ditch Sunace Water -	250 ml	H2SO4	Ammonia
(Filtered)	250 ml	NaOH	Hexavalent Chromium
			Send to Geomega - Dissolution
	2.5 gallon	None	Study
	<u> </u>		
			*Dissolved Metals (total
			chromium, trivalent chromium,
Quality Control Field Blank -	500 ml	Acid	alluminum, iron, manganese)
(DI Water)	250 ml	H2SO4	Ammonia
	250 ml	NaOH	Hexavalent Chromium

^{*} See Page 2 Laboratory Procedure Section of the Scope of Work for Floc Solubility.

Table 2 **FLOC Sampling Water Quality Parameters** June - September 2003 Olin-Wilmington

Final Sampling Parameters

Location	BACKFLOC- 2003	REDFLOC-2003	WHITEFLOC- 2003	SOEASTFLOC- 2003
Date	6/19/2003	6/25/2003	9/8/2003	6/25/2003
Depth of Water (feet)	0.60	0.25	0.62	0.65
pH (standard units)	6.61	5.38	5.60	5.78
Conductivity (µmhos/cm) (1)	404	2050	1170	412
Dissolved oxygen (mg/L)	7.42	8.97	14.54	9.71
Temperature (°Celsius)	17.43	18.72	20.30	19.21
Redox (millivolts)	62	138	137	189
Flow Velocity (ft/s)	0.04	0.00	0.00	0.00
Weather/Temperature(deg F	Sunny 75	Sunny 92	Sunny 75	Sunny 92

Notes: (1) micromhos per centimeter

Prepared by: JCN Checked by: EMA

> PN: 6300030008/06.12 11/3/2003



	Transmittal Letter						
To: Dan Stone	DATE: NOVEMBER 5, 2003						
GEOMEGA	CLIENT: OLIN						
2995 BASELINE ROAD, SUITE 2	PROJECT: OLIN WILMINGTON						
BOULDER, CO 80303	MACTEC PROJECT No.: 6300030008 - 06.05						
TEL: (303) 442-2549	DELIVERY: FEDEX						
	PLEASE FIND ENCLOSED:						
	LABORATORY RESULTS AND CHAIN OF CUSTODIES FOR FLOC SAMPLING.						
	STL Report Number - 207783						
	BACKFLOCSW-2003 6/19/03						
	BACKFLOC-2003 6/19/03						
	REDFLOCSW-2003 6/25/03						
	REDFLOC-2003 6/25/03						
	STL REPORT NUMBER - 209682						
	WHITEFLOCSW-2003 9/8/03						
	WHITEFLOC-2003 9/8/03						
	IF YOU HAVE ANY QUESTIONS, PLEASE CALL ERIC AXELROD AT (781) 213-5602.						
	THANK YOU.						
X INFORMATION PURCHASING							
☐ ESTIMATING ☐ CONSTRUCTION	PREPARED BY: K.J.AINSWORTH						
☐ COMMENTS AND/OR ☐ SEE REMARKS							
APPROVAL							
NUMBER REVISION NO. OF COPIES NO.	TITLE OR DESCRIPTION						
1 1	STL REPORT NUMBER – 207783						
2 1	STL Report Number 209682						
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MACTEC Engineering and Consulting 107 Audubon Road, Suite 301 Wakefield, MA 01880

Phone No.: (781) 245-6606 FAX No.: (781) 246-5060



Alan Peirce Olin Chemical 51 Eames Street Wilmington, MA 01887

07/10/2003

Report Number: 207783

Dear Alan Peirce,

The analysis of your sample(s) submitted on 06/20/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann Laboratory Director

Total number of pages in this report:

CASE NARRATIVE

Client: OLIN

Report Number: 207783

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 06/20/03 and 06/25/03, properly preserved, on ice and in good condition.

SW846 6010B

No reportable deviations.

Per client request, an abbreviated metals list was reported.

SW846 7196B

No reportable deviations.

The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

Inorganic

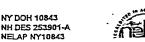
Ammonia

Ammonia recovered low and outside method control limits in the matrix spike sample. The lab control spike was within method control limits.

TSS

No reportable deviations.







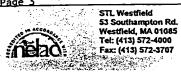
SAMPLE INFORMATION

Date: 07/10/2003

Job Number.: 207783 Customer...: Olin Chemical Attn..... Alan Peirce

Project Number..... 20001608 Customer Project ID...: FLOC SAMPLING Project Description...: Floc Sampling

taboratory Sample 10	Cistomer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
207783-1		Surf. Water	06/25/2003	12:15	06/25/2003	16:55
207783-3	BACKFLOC-2003	Surf. Water	06/19/2003	16:30	06/20/2003	13:15
207783-4	REDFLOCSW-2003	Surf. Water	06/25/2003	12:35	06/25/2003	16:55
207783-6	BACKFLOCSW-2003	Surf. Water	06/19/2003	16:40	06/20/2003	13:15
207783-7	SOEASTSW-2003	Surf. Water	06/25/2003	11:05	06/25/2003	16:55
207783-8	FIELD BLANK	Water	06/25/2003	13:15	06/25/2003	16:55
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LABORATORY TEST RESULTS

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

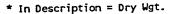
PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: REDFLOC-2003
Date Sampled.....: 06/25/2003
Time Sampled.....: 12:15
Sample Matrix....: Surf. Water

Laboratory Sample ID: 207783-1
Date Received.....: 06/25/2003
Time Received.....: 16:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	168		0.005	mg/L	07/09/03	bpg
EPA 160.2	Solids, Total Suspended (TSS)	5210		5	mg/L	06/24/03 @ars	grb 3
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	06/26/03	rwe
LAC 107061B	Ammonia (NH3), as N	319		2.0	mg/L	06/30/03	kmm
SW846 6010B	Metals Analysis (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	445000 526000 10700		5000 5000 1000	ug/L ug/L ug/L	07/09/03 07/09/03 07/09/03	bpg
-W846 6010B MC	Metals Analysis (ICP) Chromium (Cr)	168000		500	ug/L	07/09/03	bpg
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TEST RESULTS LABORATORY

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: BACKFLOC-2003 Date Sampled.....: 06/19/2003 Time Sampled.....: 16:30 Sample Matrix....: Surf. Water

Laboratory Sample ID: 207783-3 Date Received.....: 06/20/2003

Time Received.....: 13:15

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	0.160		0.005	mg/L	07/09/03	bpg
EPA 160.2	Solids, Total Suspended (TSS)	ND	U	5	mg/L	06/24/03 (2) GP 2	grb
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	06/20/03	kmm
LAC 107061B	Ammonia (NH3), as N	2.10		0.10	mg/L	06/30/03	kmm
SW846 6010B	Metals Analysis (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	17000 1630000 10500		1250 1250 250	ug/L ug/L ug/L	07/09/03 07/09/03 07/09/03	bpg
W846 6010B MC	Metals Analysis (ICP) Chromium (Cr)	161		120	ug/L	07/09/03	bpg
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* In Description = Dry Wgt.

STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707

STL Billerica 314 Billerica 149 Rangeway Rd. N. Billerica, MA 01862 Tel: (978) 667-1400 Fax: (978) 667-7871



LABORATORY TEST RESULTS

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATIN: Alan Peirce

Customer Sample ID: REDFLOCSW-2003
Date Sampled.....: 06/25/2003
Time Sampled.....: 12:35
Sample Matrix....: Surf. Water

Laboratory Sample ID: 207783-4
Date Received.....: 06/25/2003
Time Received.....: 16:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	0.068		0.005	mg/L	07/09/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	06/26/03	гне
LAC 107061B	Ammonia (NH3), as N, Diss.	18.8		0.10	mg/L	06/30/03	kmm
SW846 6010B MC	Metals Analysis Trace (ICP) Chromium (Cr), Diss.	68		10	ug/L	07/08/03	bpg
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	408 2670 965		100 100 20	ug/L ug/L ug/L	07/08/03 07/08/03 07/08/03	bpg
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* In Description = Dry Wgt.



RESULTS TEST LABORATORY

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: BACKFLOCSW-2003 Date Sampled....: 06/19/2003 Time Sampled....: 16:40 Sample Matrix....: Surf. Water

Laboratory Sample ID: 207783-6 Date Received.....: 06/20/2003 Time Received.....: 13:15

TEST METROD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	o.	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.005	mg/L	07/09/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	06/20/03	kmm
LAC 107061B	Ammonia (NH3), as N, Diss.	0.29	u	0.10	mg/L	06/30/03	kmm
SW846 6010B MC	Metals Analysis Trace (ICP) Chromium (Cr), Diss.	ND	U	10	ug/L	07/08/03	bpg
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND 633 153	U	100 100 20	ug/L ug/L ug/L	07/08/03 07/08/03 07/08/03	bpg
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* In Description = Dry Wgt.



Page 7

STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel: (413) 572-4000 Fax: (413) 572-3707





RESULTS TEST LABORATORY

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: SOEASTSW-2003 Date Sampled....: 06/25/2003 Time Sampled....: 11:05 Sample Matrix....: Surf. Water

Laboratory Sample ID: 207783-7 Date Received.....: 06/25/2003 Time Received.....: 16:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	q	REPORTING LIMIT	UNITS	DATE	TECI
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.005	mg/L	07/09/03	bpg
	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	06/26/03	rwe
LAC 107061B	Ammonia (NH3), as N, Diss.	2.59		0.10	mg/L	06/30/03	kmm
SW846 6010B MC	Metals Analysis Trace (ICP) Chromium (Cr), Diss.	ND	U	10	ug/L	07/08/03	bpg
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND ND 273	U	100 100 20	ug/L ug/L ug/L	07/08/03 07/08/03 07/08/03	bpg
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* In Description = Dry Wgt.



Page 8

Fax: (413) 572-3707

TEST RESULTS LABORATORY

Job Number: 207783

Date: 07/10/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

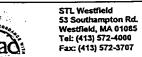
ATTN: Alan Peirce

Customer Sample ID: FIELD BLANK Date Sampled....: 06/25/2003 Time Sampled....: 13:15 Sample Matrix....: Water

Laboratory Sample ID: 207783-8 Date Received.....: 06/25/2003 Time Received.....: 16:55

			10001				
TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	٩	REPORTING LIMIT	UNITS	DATE	TEC!
SM18 3500D	Trivalent Chromium (Calc.)	ND	U	0.005	mg/L	07/09/03	
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	06/26/03	гие
LAC 107061B	Ammonīa (NH3), as N	0.11		0.10	mg/L	06/30/03	kmm
SW846 60108	Metals Analysis (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	ND ND ND	טטט	50.0 50.0 10	ug/L ug/L ug/L	07/09/03 07/09/03 07/09/03	bpg
SW846 6010B MC	Metals Analysis (ICP) Chromium (Cr)	ND	U	5.0	ug/L	07/09/03	bpg
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•1 Rangeway Road
N. rica, MA 01862
(P) 978-667-1400
(F) 978-667-7871
8TL-BILLERICA

Client: MACTEC			Pro	ject#: _	<u> 230</u>	DZ	නාවේ	/	06.0) <u>c</u>				777	l g		(c)		PO*
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Rangeway Road N. _rics, MA_01862 (P) 978-667-1400

(F) 978-667-7871 STL-BILLERICA

Client: MACTEC Engineery Olcusuling Inc.	Project #:	6300030008/06.06		
Address: 107 Avolban road Ste 301		M. Murphy	Shadedareastor office weeks Analysis Requested	Comments
WHITELD, MA 01080	_ Work ID:	o	Check analysis and specify method	(Special Instructions)
Phone: Fax:	Contact:	F	and analytes in comments section.	FIOC Program
Requested Turn Around Time 10 Business Day (Std) Rush TAT Requested:	Regulatory Classifica	ation / Special Report Format	500-series for drinking water 800-agries for waste water	
15 Business Day 24 hrs 72 hrs		GW1/S1 - MWRA Smart Rpt _ U	8000 Paries for haz/solid waste	metals;
Other 5 Day 48 hrs 5 Day	Other	MCP OA/OC Ret	2 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Cr (total)
Sample Type Codes WW-Wastewater DW-Drinking water SW-Surfacewater LW-Labwater GW-Groundwater A-Air SSolid / Soli SL-Sludge O-Oll Z-Other		# Containers # Containers	Seminea Stroffing PCB / Pectieides T EPH / VPHC T T T DRO / GRO Metals 6010 / 200.7 General Chemistry Bacteriological Toxicity Oil & Grease / TOC Other	i
Sample ID	Date	Plo O4/N O4/N O4/N O4/N O4/N O4/N O4/N O4/N		Fe
Samble ID Sample ID	Collected Collec	# Containers Plastic(P) or Glass NaHSO4/MeOH HNO3 to pH <2 H2SO4 to pH <2 HCI to pH <2 NaOH to pH >12 NaOH to pH <2 NaOH to pH	Articles (CB) (CB) (CB) (CB) (CB) (CB) (CB) (CB)	Mn
BACK CIAC -2003 SW 54/	6-19-03 K			TSS- total Suspended Soll
DITCH+IOC 2003 CT /Am	7650 K	┦╼╌╎═╏╍╌╎┈╎┈╎┈╎┈╎┈╎┈╏┈╏┈╏┈╏		Unfiltered
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e53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 stl-westfield ?angeway Road ...rica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 stl-billerica

Client: MACTEC	Project #:	6300030008/06,06	out of	PO#
Address:	Project Manager:		Analysis Requested	Comments
	Work ID:		Check analysis and specify method and spalytes in comments section.	(Special Instructions)
Phone: Fax:	Contact:	j i	For example:	Herchrome 7196/32004
Requested Turn Around Time	Regulatory Classifica	tion / Special Report Format on DEP Form(s)	500-series for d inking water 600-series for waste water	Diss metals
10 Business Day (Std) Rush TAT Requested: 15 Business Day 24 hrs 72 hrs	RCRA — MCP	GW1/S1 MWRA Smart Rpt	8000-series for haz/solld waste	·
Other 5 Day 48 hrs 5 Day	Other	MCP QA/QC Rpt	7 2	Total cr, CrIA, Al,
WW-Wastewater DW-Drinking water SW-Surfacewater			des // de	1 /// /
LW-Labwater GW-Groundwater A-Air S-Soild / Soil SL-Sludge O-Oil Z-Other	_] ·	# Containers Plastic(P) or Glass(G) NaHSO4/MeOH HNO3 to pH <2 HZSO4 to pH <2 HC to pH <2 HC to pH <2 NaOH to pH >12 NaOH to pH >12 NaOS203 None / 4° C Volatiles 524 / 624 Volatiles 8260 / 8021	Semiroa 8270/fgc- PCB / Pesticides ff EPH / VPH DRO / GRO Metals G010 / 200.7 General Chemistry Bacteriological Toxicity Oil & Grease / TOC Other	Fe, Mn)
O and a large of the control of the	Date	# Containers Plastic(P) or G NaHSO4/Me HNO3 to pH HZSO4 to pH HC to pH <z na2s2o3="" naoh="" none<="" ph="" td="" to=""><td></td><td>All Samples</td></z>		All Samples
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Redflocsw-2003 SN 59/m51	P. 1235 X			
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Severn Tont Laboratories, Inc. **Chain of Custody Form**



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•53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD

Rengeway Road rica, MA 01862 (P) 978-667-1400

(F) 978-667-7871 STL BILLERICA

Client: MACTEZ	_ Project #:	63200 32008/06.06		PO#
Address:	Project Manager:		Analysis Requested	Comments (Special Instructions)
Phone: Fax:	_ Work ID: _ Contact:		Check analysis and specify method had analytes in comments section. For example:	Distilled curitien
Requested Turn Around Time	Regulatory Classifica	tion / Special Report Format ong Water DEP Form(s)	560-series for drinking water 600-series for waste water	UNFILTERED
15 Business Day 24 hrs 72 hrs	RCRA MCP	GW1/S1 — MWRA Smart Rpt —	2 8000-series for haz/solld waste	
Other 48 hrs 5 Day Sample Type Codes WW-Wastewater DW-Drinking water SW-Surfacewater	Other	MCP QA/QC Rpt S		Hexchrome 156/36
W-Labwater GW-Groundwater A-Air S-Solid / Soil SL-Studge O-Oil Z-Other		S Glass((eOH	1279 / HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	Dss. metals:
Sample ID	Date Sign	# Containers Plastic(P) or Glass(G) NaHSO4/MeOH HNO3 to pH <2 H2SO4 to pH <2 HCI to pH <2 HCI to pH <2 NaOH to pH >12 NaOH to pH >12 NaOH to pH >12 None / 4° C Volatiles 524 / 624 Volatiles 8260 / 8021	Semivea 8279 / PCB / Poetieides / PCB / Poetieides / PCB / P	Total Cr, Cr Al Al
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Alan Peirce Olin Chemical 51 Eames Street Wilmington, MA 01887

09/18/2003

Report Number: 209682

Dear Alan Peirce,

The analysis of your sample(s) submitted on 09/09/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann Laboratory Director STL Westfield

Technical Review: 14 9/19/03

Total number of pages in this report:____

MCP CASE NARRATIVE

Client: Olin

Report Number: 209682

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 09/09/03; the samples arrived in good condition, properly preserved and on ice.

SW846 7196A

There were no QA/QC deviations or issues reported for this method.

SW846 6010B

At the request of the client, an abbreviated MCP analyte list was reported for this job.

An ICSA/AB solution, which monitors spectral interference, was not performed at the end of the analytical instrument run as per method 6010MCP. An initial ICSA/AB standard was performed and met all criteria established in 6010MCP.

The Matrix Spike (MS) solution is from the same source as the calibration standards, however an Initial Calibration Verification (ICV) standard was analyzed from a secondary source. Matrix spike recoveries are noted on the accompanying QC report.

There were additional no QA/QC deviations or issues reported for this method.

The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

EPA 160.2

There were no QA/QC deviations or issues reported for this method.

LAC 107061B (Ammonia)

There were no QA/QC deviations or issues reported for this method.









SAMPLE INFORMATION Date: 09/18/2003

Job Number.: 209682 Customer...: Olin Chemical Attn....: Alan Peirce

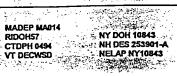
Project Number.....: 20001608
Customer Project ID...: FLOC SAMPLING
Project Description...: Floc Sampling

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Laboratory Sample ID	Customer Sample:ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
209682-1	Whitefloc-2003	Surf. Water	09/08/2003	16:20	09/09/2003	08:25
209682-2	WhiteflocsW-2003	Surf. Water	09/08/2003	16:40	09/09/2003	08:25
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Job Number: 209682

Date: 09/18/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Whitefloc-2003 Date Sampled.....: 09/08/2003 Time Sampled.....: 16:20 Sample Matrix....: Surf. Water Laboratory Sample ID: 209682-1
Date Received...... 09/09/2003
Time Received...... 08:25

TEST METROD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	128	\prod	0.010	mg/L	09/17/03	bpg
EPA 160.2	Solids, Total Suspended (TSS)	6510		5	mg/L	09/10/03	grb
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	09/09/03	kmm
LAC 107061B	Ammonia (NH3), as N	37.2		2.0	mg/L	09/17/03	kmm
SW846 6010B	Metals Analysis (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	548000 482000 6390		2000 2000 400	ug/L ug/L ug/L	09/17/03 09/17/03 09/17/03	bpg
SW846 6010B MC	Metals Analysis (ICP) Chromium (Cr)	128000		200	ug/L	09/17/03	bpg
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* In Description = Dry Wgt.





RESULTS LABORATORY TEST

Job Number: 209682

Date: 09/18/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: WhiteflocSW-2003 Date Sampled....: 09/08/2003 Time Sampled....: 16:40 Sample Matrix....: Surf. Water

Laboratory Sample ID: 209682-2 Date Received.....: 09/09/2003 Time Received.....: 08:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TE(
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.010	mg/L	09/17/03	bpg
W846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	09/09/03	km
LAC 107061B	Ammonia (NH3), as N, Diss.	23.0		1.0	mg/L	09/17/03	km
SW846 6010B	Dissolved Metals Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND 372 582	U	100 50 10	ug/L ug/L ug/L	09/17/03 09/17/03 09/17/03	bp
W846 6010B MC	Dissolved Metals Analysis (ICP) Chromium (Cr), Diss.	ND .	U	10	ug/L	09/17/03	bp
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In Description = Dry Wgt.





Severn Trent Laboratories, Inc. Chain of Custody Form

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•53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 19 Rangeway Road ... Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871

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Alan Peirce Olin Chemical 51 Eames Street Wilmington, MA 01887

08/11/2003

Report Number: 208708

Dear Alan Peirce,

The analysis of your sample(s) submitted on 07/25/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

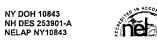
Steven C. Hartmann

Laboratory Director

Total number of pages in this report: 27

Laborator	y Name:	Severn Tre	nt Laborato	ory (STL) W	/estfield	Project #:	2087	08
Project Lo	ocation:				MA	DEP RTN ¹ :		•
This form 208708 1-	provides certific	cations for the fo	ollowing data s	et:[list Labora	tory Sample ID	Number(s)]		
Sample M		Groundwater 8260B()	Soil/Se	diment 8330 ()	Drinking Water	Other: 7470A/1A ()		her (X)
Methods	and the second second	8270C()	8081A()	VPH ()	6020 ()	9014M ² ()	- 1	ner (X)
	edin MADEP	8082 ()	8021B ()	EPH()	7000 S ³ ()	7196A (X)		
	Methods that apply)	2 M - SW-846 3 S - SW-846	Methods 7000	or MADEP P Series List i	hysiologically A ndividual metho	vailable Cyanide od and analyte. Certainty" stat		thod
Α	Were all samp	ples received by I on the Chain-c	the laboratory	in a condition	n consistent wit		Yes	No ¹
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С	for "Presumpti document CAM	ytical data inclu ive Certainty", a M VII A, " Qualit ition and Report	s described in y Assurance a	Section 2.0 o	f the MADEP		Yes	No ¹
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D		erformance sta	ndards and red	commendation	ns for the		Yes	No
E	Were results for method(s) repo	or all analyte-lis orted?	t compounds/e	elements for the	ne specified		Yes	No
	¹ All NO ans	wers must be a	ddressed in ar	attached En	vironmental Lat	oratory case na	rrative.	
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i	Printed Name:	Steven C. Ha	rtmann		Date:	8/11/03		







CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208708

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 07/25/03 properly preserved, on ice and in good condition.

Inorganic

SW846 7196MCP

For sample 208708-09 (Redfloc), the sample had high intrinsic color; therefore a dilution was made to reduce interferences. The instrument was zeroed using an untreated portion of the sample at the respective dilution. This sample is reported on a wet weight basis due to insufficient sample volume to perform the percent solids analysis.

SW846 6010B

For sample 208708-09 (Redfloc), the sample is reported on a wet weight basis due to insufficient sample volume to perform the percent solids analysis.

Due to problems associated with sample contamination when preparing soil based Method Blanks and wide control limits when analyzing soil Laboratory Control Standards, an aqueous based LCS and MB was substituted for this job and brought though the entire preparation process. Both the MB and LCS met method recovery control specifications.

Poor matrix spike recoveries were noted for the batch QC results on aluminum, iron and manganese. The LCS recovered within acceptable control limits.

At the request of the client, an abbreviated MCP analyte list was reported for this job.

The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

Metals

EPA 200.7

No reportable deviations.

Trivalent Chromium (calculation)

No reportable deviations.









QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 08/11/2003

STL WESTFIELD

DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."

Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:

Inorganic Qualifiers (Q-column):

- U Indicates that the analyte was analyzed for but not detected.
- E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
- B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):

- U Indicates that the compound was analyzed for but not detected.
- J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
- B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.
- D Indicates all compounds identified in an analysis at a secondary dilution factor.
- E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.





MADEP MA014

CTDPH 0494

VT DECWSD

RIDOH57



QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 08/11/2003

- Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.
- Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.
- Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.
- Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.
- Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

- The following comments are specific to Diesel Range Organics (DRO), by GC/FID:
- Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.
- Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.
- Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".



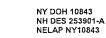


SAMPLE INFORMATION Date: 08/11/2003

Job Number.: 208708 Customer...: Olin Chemical Attn....: Alan Peirce

Project Number.....: 20001355
Customer Project ID...: ADDITIONAL ANALYSIS
Project Description...: Additional Analysis

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
208708-1	Red f 4	Surf. Water	07/24/2003	12:30	07/25/2003	11:11
208708-2	Red f 5	Surf. Water	07/24/2003	13:00	07/25/2003	11:11
208708-3	Red f 7	Surf. Water	07/24/2003	13:30	07/25/2003	11:11
208708-4	Red f 8	Surf. Water	07/24/2003	14:00	07/25/2003	11:11
208708-5	Red f 724	Surf. Water	07/24/2003	14:15	07/25/2003	11:11
208708-6	Red f 716	Surf. Water	07/24/2003	12:00	07/25/2003	11:11
208708-7	Red f 78	Surf. Water	07/24/2003	17:30	07/25/2003	11:11
208708-8	Red f 72	Surf. Water	07/24/2003	15:30	07/25/2003	11:11
208708-9	Redfloc	Soil	07/24/2003	14:00	07/25/2003	11:11
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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD



Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 4
Date Sampled.....: 07/24/2003
Time Sampled.....: 12:30
Sample Matrix....: Surf. Water

Laboratory Sample ID: 208708-1
Date Received.....: 07/25/2003

Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	۵	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	0.399		0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	6470 399 ND 665	U	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg



Job Number: 208708 Date: 08/11/2003

CUSTOMER: Olin Chemical PROJECT: ADDITIONAL ANALYSIS ATTN: Alan Peirce

Customer Sample ID: Red f 5
Date Sampled....: 07/24/2003
Time Sampled....: 13:00
Sample Matrix....: Surf. Water

Laboratory Sample ID: 208708-2
Date Received.....: 07/25/2003
Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	0.022	Ī	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	156 22 ND 651	U	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg





Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical PROJECT: ADDITIONAL ANALYSIS ATTN: Alan Peirce

Customer Sample ID: Red f 7
Date Sampled.....: 07/24/2003 Time Sampled.....: 13:30 Sample Matrix....: Surf. Water Laboratory Sample ID: 208708-3 Date Received.....: 07/25/2003 Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	ND	U	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	ND ND ND 307	UU	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
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* In Description = Dry Wgt.



Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 8 Date Sampled: 07/24/2003 Time Sampled.....: 14:00 Sample Matrix....: Surf. Water Laboratory Sample ID: 208708-4 Date Received.....: 07/25/2003 Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	ND	U	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	0.0079		0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	153 10 ND ND	ככ	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
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Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 724
Date Sampled.....: 07/24/2003 Time Sampled.....: 14:15 Sample Matrix....: Surf. Water

Laboratory Sample ID: 208708-5 Date Received.....: 07/25/2003

Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	ND	υ	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	ND ND ND 284	טטט	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
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^{*} In Description = Dry Wgt.



Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 716
Date Sampled.....: 07/24/2003
Time Sampled.....: 12:00
Sample Matrix....: Surf. Water

Laboratory Sample ID: 208708-6
Date Received.....: 07/25/2003

Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.)	0.014		0.010	mg/L	08/06/03	bpg
1846 7196 MCP	Hexavalent Chromium	ND	υ	0.0050	mg/L	07/25/03	km
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	ND 14 ND 217	U	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bp



Page 9

Fax: (413) 572-3707

Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 78
Date Sampled.....: 07/24/2003
Time Sampled.....: 17:30
Sample Matrix....: Surf. Water

Laboratory Sample ID: 208708-7
Date Received.....: 07/25/2003

Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	ND	U	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	ND ND ND 233	כטט	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg

* In Description = Dry Wgt.



Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Chemical

PROJECT: ADDITIONAL ANALYSIS

ATTN: Alan Peirce

Customer Sample ID: Red f 72
Date Sampled....: 07/24/2003
Time Sampled....: 15:30
Sample Matrix...: Surf. Water

Laboratory Sample ID: 208708-8 Date Received.....: 07/25/2003 Time Received.....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	ND	U	0.010	mg/L	08/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.0050	mg/L	07/25/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al) Chromium (Cr) Iron (Fe) Manganese (Mn)	ND ND ND 149	טטט	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
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Job Number: 208708 Date: 08/11/2003

CUSTOMER: Glin Chemical PROJECT: ADDITIONAL ANALYSIS ATTN: Alan Peirce

Customer Sample ID: Redfloc
Date Sampled....: 07/24/2003
Time Sampled....: 14:00
Sample Matrix...: Soil

Laboratory Sample ID: 208708-9
Date Received.....: 07/25/2003

Time Received....: 11:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	6030		1.00	mg/Kg	08/07/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	U	0.95	mg/Kg	08/06/03	rwe
SW846 6010B MC	Metals Analysis Trace (ICP) Chromium (Cr)	6030		6.46	mg/Kg	08/01/03	rac
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	15000 20200 22.2		64.6 32.3 6.46	mg/Kg mg/Kg mg/Kg	08/01/03 08/01/03 08/01/03	rac
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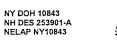
LABORATORY CHRONICLE

Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Ch	emicat	PROJECT: ADDITE	ONAL ANALYSIS		ATTN: Alan Peirce	
Lab ID: 208708-1	Client ID: Red f 4		ecvd: 07/25/2003		Date: 07/24/2003	
METHOD	DESCRIPTION	RUN#	BATCH# PREP B	T #(S)	DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
SW846 7196 MCP		1	15579		07/25/2003 1335	
EPA 200.7	Metal Analysis (ICP)	1	15910 15757		08/06/2003 1531	
	QC Metals Report, Level 2	1	15902		08/06/2003 1635	
0140 7500b	QC Wet Chemistry Report, Level 2	1	15919		08/06/2003 0000 08/06/2003 1748	
SM18 3500D	Trivalent Chromium	1	15912			
Lab ID: 208/08-2	Client ID: Red † 5		ecvd: 07/25/2003		Date: 07/24/2003 DATE/TIME ANALYZED	DILUTION
METHOD	DESCRIPTION		BATCH# PREP B	1 #(5)	08/04/2003 0800	DILOTION
EPA 200.7	Acid Digestion, Total (ICAP)	1 1	15757 15579		07/25/2003 1338	
SW846 7196 MCP					08/06/2003 1534	
EPA 200.7	Metal Analysis (ICP)	1			08/06/2003 1748	
SM18 3500D	Trivalent Chromium	1	15912		08/00/2003 1748	
Lab ID: 208708-3	Client ID: Red f 7		ecvd: 07/25/2003		Date: 07/24/2003	DILLITION
METHOD	DESCRIPTION		BATCH# PREP B	I #(S)	DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
SW846 7196 MCP		1	15579		07/25/2003 1338	
EPA 200.7	Metal Analysis (ICP)	1	15910 15757		08/06/2003 1537	
SM18 3500D	Trivalent Chromium	1	15912		08/06/2003 1748	
Lab ID: 208708-4	Client ID: Red f 8		cvd: 07/25/2003		Date: 07/24/2003	
METHOD	DESCRIPTION	RUN#	BATCH# PREP B	T #(S)	DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
SW846 7196 MCP	Hexavalent Chromium	1	15579		07/25/2003 1339	
EPA 200.7	Metal Analysis (ICP)	1	15910 15757		08/06/2003 1540	
SM18 3500D	Trivalent Chromium	1	15912		08/06/2003 1748	
Lab ID: 208708-5	Client ID: Red f 724	Date Re	cvd: 07/25/2003	Sample	Date: 07/24/2003	
METHOD	DESCRIPTION	RUN#	BATCH# PREP B	T #(S)	DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15 <i>7</i> 57		08/04/2003 0800	
SW846 7196 MCP		1	1557 9		07/25/2003 1340	
EPA 200.7	Metal Analysis (ICP)	1	15910 15757		08/06/2003 1543	
SM18 3500D	Trivalent Chromium	. 1	15912		08/06/2003 1748	
Lab ID: 208708-6	Client ID: Red f 716	Date Re	ecvd: 07/25/2003	Sample	Date: 07/24/2003	
METHOD	DESCRIPTION		BATCH# PREP B		DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
	Hexavalent Chromium	1	15579		07/25/2003 1341	
EPA 200.7	Metal Analysis (ICP)	1	15910 15757		08/06/2003 1625	
SM18 3500D	Trivalent Chromium	1	15912		08/06/2003 1748	
Lab ID: 208708-7	Client ID: Red f 78	Date Re	ecvd: 07/25/2003	Sample	Date: 07/24/2003	
METHOD	DESCRIPTION		BATCH# PREP B		DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
SW846 7196 MCP	Hexavalent Chromium	i	15579		07/25/2003 1342	
EPA 200.7	Metal Analysis (ICP)	i	15910 15757	-	08/06/2003 1629	
SM18 3500D	Trivalent Chromium	i	15912		08/06/2003 1748	
Lab ID: 208708-8	Client ID: Red f 72	Date Re	ecvd: 07/25/2003	Sample	Date: 07/24/2003	
METHOD	DESCRIPTION		BATCH# PREP B		DATE/TIME ANALYZED	DILUTION
EPA 200.7	Acid Digestion, Total (ICAP)	1	15757		08/04/2003 0800	
SW846 7196 MCP	Hexavalent Chromium	i	15579		07/25/2003 1343	
EPA 200.7	Metal Analysis (ICP)	ί	15910 15757		08/06/2003 1632	
SM18 3500D	Trivalent Chromium	1	15912		08/06/2003 1748	
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LABORATORY CHRONICLE

Job Number: 208708

Date: 08/11/2003

CUSTOMER: Olin Ch	emical	PROJECT: ADDITE	ONAL ANA	LYSIS		ATTN: Alan Pe	irce	
Lab ID: 208708-9	Client ID: Redfloc	Date Re	cvd: 07/	25/2003	Sample	Date: 07/24/	2003	
METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT	#(S)	DATE/TIME	ANALYZED	DILUTION
SW846 3050B MC	Acid Digestion (ICP) Solids	1	15682			07/31/2003	0800	
SW846 3060A	Alkaline Digestion for CR6	1	15917			08/06/2003	0000	
SW846 7196 MCP	Hexavalent Chromium	1	15918			08/06/2003	0000	
SW846 6010B	Metals Analysis Trace (ICP)	1	15778	15675		08/01/2003	1511	10
	Metals Analysis Trace (ICP)	i	15779	15675		08/01/2003	1511	10
SM18 3500D	Trivalent Chromium	i	15930	15015		08/07/2003		



QUALITY CONTROL RESULTS

JOB NUMBER:

208708

CLIENT:

OLIN

208708-1 Units:mg/L

208708-9 Units:mg/Kg

Analyte	Sample Identification	No. 10 122 15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Sample RL	Sample Result	Spike Conc.		MS % Rec	Spike Dup	MSD % Rec	ŘPD Q	Spike Limits	LCS TRUE	LCS Found	LCS % Rec	LCS QC Q Limits	Date Analyzed
Hexavalent Chromium	208708-1	0.05U	0.05U	0.00	0.25	0.22	88.2	0.22	88.2	0.0	75-125		0.0	91.2		07/25/03
Hexavalent Chromium	208708-9	0.2U	0.95U	0.0	42.9	33.4	77.9				75-125	39.3	31.9	81.2	80-120	08/06/03





QUALITY CONTROL RESULTS SW846 6010/7471

Job Number: 208708

Units: mg/kg

Extraction Batch: 15675 Analytical Batch: 15779

Client: Olin Chemical

Andleta:	QC Sample	MB	Sample	Sample	Sample		Spike	Matrix	MS %		Spike	LCS	LOS	'LGS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc	Spiķe	Réc			TRUE	found	% Rec. Q	Limits	Analyzed
Aluminum	208737-16	0.2U	0.2	6012.4	7876.5	27	58.2	5875	0	*	75-125	1000	1005	101	80-120	8/1/03
Chromium	208737-16	1U	1	25.4	29.2	14	29.1	51	88		75-125	500	470	94	80-120	8/1/03
Iron	208737-16	5U	5	23932.7	27305.3	13	29.1	24198	912	*	75-125	500	562	112	80-120	8/1/03
Manganese	208737-16	1U	1	375.6	431.5	14	29.1	451	260	*	75-125	500	490	98	80-120	8/1/03
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MADEP MA014 RIDOH57

NY DOH 10843 CTDPH 0494 NH DES 253901-A VT DECWSD **NELAP NY 10843**



STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707

STL Billerica-Service Center 149 Rangeway Rd. Billerica, MA 01862 Tel:(978) 667-1400

Fax(978) 667-7871

RPD=<20

QUALITY CONTROL RESULTS

Job Number: 208708 Client:

Olin Chemical

Units: µg/L

Extraction Batch: 15757

Analytical Batch:

2.49	QC Sample	МВ	Sample	Sample	Sample	2 may 188 may 1990	Spike	Matrix	MS %	Špike	LCS	Los	LCS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc.	Spike		Q Limits	TRUE	found	% Rec	Q Limits	Analyzed
							ξ.				p. Water State of Total State of	61. No S. C. C. T. Alle T. A.			a.i. iidiy.Zou
Aluminum	208810-1	100U	100	0.0	0.0	0	1000	922	92	75-125	1000	927	93	80-120	8/6/03
Chromium	208810-1	10U	10	0.0	0.0	0	1000	915	92	75-125	1000	904	90	80-120	8/6/03
Iron	208810-1	50U	50	24010	24264	1	1000	24858	85	75-125	1000	1009	101	80-120	8/6/03
Manganese	208810-1	10U	10	3549	3589	1	1000	4430	88	75-125	1000	889	89	80-120	8/6/03
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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD

NY DOH 10843 NH DES 253901-A **NELAP NY 10843**



STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707

STL Billerica-Service Center 149 Rangeway Rd.

Billerica, MA 01862 Tel:(978) 667-1400 Fax(978) 667-7871

RPD =<20

rpjsckl Job Sample Re	eceipt Checklist Report V2
Job Number.: 208708 Location.: 57345 Check List N Customer Job ID: Job Check Project Number.: 20001609 Project Description.: East Customer: Olin Chemical	List Date.: Date of the Report • 07/25/2003
Questions ? (Y/N)	Comments
Chain-of-Custody Present?	
If "yes", completed properly?	
Custody seal on shipping container?	
If "yes", custody seal intact?	
Custody seals on sample containers?	
If "yes", custody seal intact?	
Samples iced? Y	
Temperature of cooler acceptable? (4 deg C +/- 2). Y	
Temperature at receipt	5.3c
Samples received intact (good condition)? Y	
Volatile samples acceptable? (no headspace)	
Is a Trip Blank required?	
Was a Trip Blank provided?	
Correct containers used? Y	
Adequate sample volume provided? Y	
Samples preserved correctly? Y	
Samples received within holding-time? Y	
Agreement between COC and sample labels? Y	
Comments	
If samples were shipped was there an air bill #? Y	FedEx 835812325313
Sample Custodian Signature/Date	njb 07/25/03 Mault Seyen

Severn Trent Laboratories, Inc.Chain of Custody Form



02587 208*70K* •53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 STL-WESTFIELD •149 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Olin Corp Geometa Project #: C03303F Address: 2995 Baseline Rd Ste 202 Project Manager: Dan Stane Boulder Co, 80303 Work ID: Phone: 3034439117 Fax: 3039388123 Contact: Craig Walker Andrew Nicholson For example: Requested Turn Around Time Regulatory Classification / Special Report Format Project #: C03303F Shaded areas for office use Comments Analysis Requested Check analysis and specify method and analytes in comments section. For example: 500-series for drinking water followed and analytes for waste water.	ictions)
Boulder CO, 80303 Work ID: Check analysis and specify method and analytes in comments section. Phone: 3034439117 Fax: 3039388123 Contact: Craig Welker / Andrew Nicholem For example: Requested Turn Around Time Regulatory Classification / Special Report Format 500-series for drinking water Analyte list:	
Phone: 3034439117 Fax: 3034388123 Contact: Craig Walker / Andrew Nicholson For example: Requested Turn Around Time Regulatory Classification / Special Report Format 500-series for drinking water Analyte list:	
Requested Turn Around Time Regulatory Classification 7 Special Report Format Substituting Water 150 Processes to difficulty 46 1151	
10 Business Day (Std) Rush TAT Requested: NPDES Drinking Water DEP Form(s) 600-series for waste water 8000-series for haz/solid waste	7,005
15 Business Day 24 hrs 72 hrs RCRA MCP GW1/S1 MWRA Smart Rpt Use comments section to further define.	1
Sample Type Codes W-Surfacewater W-Surfacewater W-Surfacewater	otal
THE Masternate Bit Britishing water at Canada and the Canada and t	rrivalent
Sample ID Sample ID Semivoa 625 Other Collected Compo Compo Date Condities 8260 / Ordatiles 8260 / O	
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Red f 5	
Red f 7 B30 hexavalent	-hromium.
Red f 8 724 03 1490	
7 24 03	
Red f 716 /200 /200	
Redf 78 72403	
Red 72 SW 1530	
Red floc 5 aw 12403 1	
Sampled by (print): Craig R. Walker 7/24/03 Signature: January 7/25/03 1111 Gooler 7 10/1 N Samp	les Ided? 🕢 N
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Method of shipment: STL-Westfield By: Date:	7/25/03

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Alan Peirce Olin Chemical 51 Eames Street Wilmington, MA 01887

08/12/2003

Report Number: 208827

Dear Alan Peirce,

The analysis of your sample(s) submitted on 07/31/2003 is now complete and the appropriate analytical report is enclosed. samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the tests performed on these samples, unless otherwise noted in the case narrative.

If you have any questions regarding this report or any part of our service, please do not hesitate to contact us. Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

STL Westfield

Steven C. Hartmann

Laboratory Director

Total number of pages in this report: 25

MADEP MCP Analytical Method Report Certification Form								
Laboratory Name: Severn Trent Laboratory (STL) Westfield Project #:							208827	
Project Location: MADEP RTN ¹ :								
This form p	provides certific	ations for the fo	llowing data set:[list Laborat	tory Sample ID	Number(s)]			
208827 1-1	11							
Sample Ma	atrices:	Groundwater	Soil/Sediment	Drinking Wate				
MCP SW- Methods		8260B() 8270C()	8151A () 8330 () 8081A () VPH ()	6010B (X)	7470A/1A () 9014M ² ()	Oth	er(X)	
As specifie	d in MADEP.	8082 ()	8021B() EPH()	7000 S ³ ()	7196A (X)			
Gompendio Analytical I (check all t	Methods:	2 M - SW-846	Tracking Number (RTN), if Method 9014 or MADEP Ph Methods 7000 Series List in	nysiologically A	Available Cyanide nod and analyte.	e (PAC) Met	hod	
An affirma	tive response	to questions A	A, B, and C is required for	"Presumptive	e Certainty" stat	us		
Α	Were all samp that described	les received by on the Chain-or	the laboratory in a condition for f-Custody documentation for	consistent wind the consistent wind consistent with consistent with consistent with the consistent with consis	th	(Yés)	No ¹	
В	Were all QA/QC procedures required for the specified analytical method(s) included in this report followed, including the requirement to note and discuss in a narrative QC data that did not meet appropriate performance standards or guidelines?						No ¹	
С	Does the analytical data included in this report meet all the requirements for "Presumptive Certainty", as described in Section 2.0 of the MADEP document CAM VII A, " Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?						No ¹	
	A response	to questions	D and E below is required	for "Presum	ptive Certainty"	status		
D		erformance star	ndards and recommendation	ns for the		Yes	No	
E	Were results for method(s) repo		t compounds/elements for t	he specified		Yes	<u> </u>	
	¹ All NO ans	wers must be a	ddressed in an attached En	vironmental La	aboratory case na	arrative.		
			ins and penalties of perjur			nal		
inquiry of those responsible for obtaining the information, the material contained in this								
analytical report is, to the best of my knowledge and belief, accurate and complete.								
	Signature: Position: Laboratory Director							
	Printed Name: Steven C. Hartmann Date:							

CASE NARRATIVE

Client: OLIN Chemical

Report Number: 208827

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues.

Samples were received on 07/31/03 properly preserved, on ice and in good condition.

Inorganic

SW846 7196MCP

For sample 208827-11 (Backfloc), the sample had high intrinsic color; therefore a dilution was made to reduce interferences. The instrument was zeroed using an untreated portion of the sample at the respective dilution. This sample is reported on a wet weight basis due to insufficient sample volume to perform the percent solids analysis.

SW846 6010B

For sample 208827-11 (Backfloc), the sample is reported on a wet weight basis due to insufficient sample volume to perform the percent solids analysis.

Due to problems associated with sample contamination when preparing soil based Method Blanks and wide control limits when analyzing soil Laboratory Control Standards, an aqueous based LCS and MB was substituted for this job and brought though the entire preparation process. Both the MB and LCS met method recovery control specifications.

Poor matrix spike recoveries were noted for the MS results for iron on both the aqueous and soil samples and aluminum for the soil sample. The sample concentrations overwhelmed the amount of spike added. The LCS recovered within acceptable control limits.

At the request of the client, an abbreviated MCP analyte list was reported for this job.

The following reported method is not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

Metals

EPA 200.7

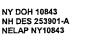
No reportable deviations.

Trivalent Chromium (calculation)

No reportable deviations.









QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 08/12/2003

STL WESTFIELD DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."

Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:

Inorganic Qualifiers (Q-column):

U Indicates that the analyte was analyzed for but not detected.

- E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
- B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):

U Indicates that the compound was analyzed for but not detected.

- J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
- B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.

D Indicates all compounds identified in an analysis at a secondary dilution factor.

E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.





MADEP MA014

RIDOH57

CTDPH 0494

VT DECWSD



QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 08/12/2003

- Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.
- Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.
- Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.
- Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.
- Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

- Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.
- Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.
- Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".







SAMPLE INFORMATION

Date: 08/12/2003

Job Number.: 208827 Customer...: Olin Chemical Attn.....: Alan Peirce Project Number.....: 20001608 Customer Project ID...: FLOC SAMPLING Project Description...: Floc Sampling

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
208827-1	Bf4	Water	07/30/2003	14:00	07/31/2003	10:40
208827-2	Bf5	Water	07/30/2003	14:15	07/31/2003	10:40
208827-3	Bf7	Water	07/30/2003	14:30	07/31/2003	10:40
208827-4	Bf8	Water	07/30/2003	14:45	07/31/2003	10:40
208827-5	Bf4s	Water	07/30/2003	15:00	07/31/2003	10:40
208827-6	Bf5s	Water	07/30/2003	15:15	07/31/2003	10:40
208827-7	Bf7s	Water	07/30/2003	15:30	07/31/2003	10:40
208827-8	Bf8s	Water	07/30/2003	15:45	07/31/2003	10:40
208827-9	Bfsws	Water	07/30/2003	16:00	07/31/2003	10:40
208827-10	Bfws	Water	07/30/2003	16:15	07/31/2003	10:40
208827-11	Backfloc	Soil	07/30/2003	16:30	07/31/2003	10:40
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			1			
			;			
			1			



RESULTS LABORATORY TEST

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf4 Date Sampled....: 07/30/2003 Time Sampled....: 14:00 Sample Matrix....: Water

Laboratory Sample ID: 208827-1
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.), Diss.	0.036		0.010	mg/L	08/12/03	bpg
W846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.025	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	1670 36 192000 3660		100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg



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Fax: (413) 572-3707

LABORATORY TEST RESULTS

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf5
Date Sampled.....: 07/30/2003
Time Sampled.....: 14:15
Sample Matrix....: Water

Laboratory Sample ID: 208827-2
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	1340 ND 155000 3660	U	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
				·			



LABORATORY TEST RESULTS

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf7 Date Sampled..... 07/30/2003 Time Sampled....: 14:30 Sample Matrix....: Water

Laboratory Sample ID: 208827-3 Date Received.....: 07/31/2003 Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	a	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	υ	0.010	mg/L	08/12/03	bpg
√846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.010	mg/L	07/31/03	kmn
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND ND 278 1240	U	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg
						;	<u>.</u>

* In Description = Dry Wgt.



TEST RESULTS LABORATORY

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf8
Date Sampled....: 07/30/2003 Time Sampled....: 14:45 Sample Matrix....: Water

Laboratory Sample ID: 208827-4

Date	Received:	07/31/2003
Time	Received:	10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND ND ND 288	טטט	100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg



LABORATORY TEST RESULTS

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf4s Date Sampled....: 07/30/2003 Time Sampled....: 15:00 Sample Matrix....: Water

Laboratory Sample ID: 208827-5 Date Received.....: 07/31/2003 Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.), Diss.	103		0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	2230 103000 519000 16400		200 100 500 40	ug/L ug/L ug/L ug/L	08/06/03 08/12/03 08/07/03 08/06/03	bpg bpg

* In Description = Dry Wgt.

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LABORATORY TEST $R\;E\;S\;U\;L\;T\;S$

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf5s Date Sampled....: 07/30/2003 Time Sampled....: 15:15 Sample Matrix....: Water

Laboratory Sample ID: 208827-6 Date Received.....: 07/31/2003 Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	53.9		0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	1340 53900 433000 9250		200 100 200 40	ug/L ug/L ug/L ug/L	08/06/03 08/12/03 08/06/03 08/06/03	bpg bpg

* In Description = Dry Wgt.

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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD

LABORATORY TEST RESULTS

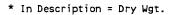
Job Number: 208827 Date: 08/12/2003

CUSTOMER: Olin Chemical PROJECT: FLOC SAMPLING ATTN: Alan Peirce

Customer Sample ID: Bf7s
Date Sampled.....: 07/30/2003
Time Sampled.....: 15:30
Sample Matrix....: Water

Laboratory Sample ID: 208827-7
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TE
SM18 3500D	Trivalent Chromium (Calc.), Diss.	1.92		0.010	mg/L	08/12/03	bp
846 7196 MCP	Hexavalent Chromium, Diss.	ND	υ	0.010	mg/L	07/31/03	km
W846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	267 1920 156000 3400		100 10 100 20	ug/L ug/L ug/L ug/L	08/05/03 08/05/03 08/05/03 08/05/03	bp





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Fax: (413) 572-3707

LABORATORY TEST RESULTS

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bf8s
Date Sampled.....: 07/30/2003
Time Sampled.....: 15:45
Sample Matrix....: Water

Laboratory Sample ID: 208827-8
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	0.915		0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	υ	0.010	mg/L	07/31/03	kmm
sw846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	177 915 97600 3460		100 10 100 20	ug/L ug/L ug/L ug/L	08/06/03 08/06/03 08/06/03 08/06/03	bpg bpg
					:		
						:	



RESULTS LABORATORY TEST

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin Chemical

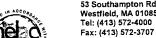
PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Bfsws Date Sampled....: 07/30/2003 Time Sampled....: 16:00 Sample Matrix....: Water

Laboratory Sample ID: 208827-9
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	205		0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	u	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND 205000 643 509	บ	200 1000 200 40	ug/L ug/L ug/L ug/L	08/06/03 08/12/03 08/06/03 08/06/03	bpg bpg



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LABORATORY TEST RESULTS

Job Number: 208827 Date: 08/12/2003

CUSTOMER: Olin Chemical PROJECT: FLOC SAMPLING ATTN: Alan Petrce

Customer Sample ID: Bfws
Date Sampled.....: 07/30/2003
Time Sampled.....: 16:15
Sample Matrix....: Water

Laboratory Sample ID: 208827-10
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	215		0.010	mg/L	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	υ	0.010	mg/L	07/31/03	kmm
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al), Diss. Chromium (Cr), Diss. Iron (Fe), Diss. Manganese (Mn), Diss.	ND 215000 364 ND	U	100 1000 100 20	ug/L ug/L ug/L ug/L	08/07/03 08/12/03 08/07/03 08/07/03	bpg bpg

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Fax: (413) 572-3707

LABORATORY TEST RESULTS

Job Number: 208827

Date: 08/13/2003

CUSTOMER: Olin Chemical

PROJECT: FLOC SAMPLING

ATTN: Alan Peirce

Customer Sample ID: Backfloc
Date Sampled....: 07/30/2003
Time Sampled....: 16:30
Sample Matrix...: Soil

Laboratory Sample ID: 208827-11
Date Received.....: 07/31/2003
Time Received.....: 10:40

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	3.44	1.00	mg/Kg	08/12/03	bpg
SW846 7196 MCP	Hexavalent Chromium	ND	0.96	mg/Kg	08/06/03	rwe
SW846 6010B MC	Metals Analysis Trace (ICP) Chromium (Cr)	3.44	2.64	mg/Kg	08/12/03	bpg
SW846 6010B	Metals Analysis Trace (ICP) Aluminum (Al) Iron (Fe) Manganese (Mn)	350 36600 114	26.4 13.2 2.64	mg/Kg mg/Kg mg/Kg	08/12/03 08/12/03 08/12/03	bpg
				# 		i i



LABORATORY CHRONICLE

Job Number: 208827

Date: 08/12/2003

CUSTOMER: Olin C	hemical	PROJECT: FLOC	CAMDI TAIC			ATTN: Alan Det		
		. NOUCELY FEUL	SAMELINU			ATTN: Alan Pei	ı ce	
Lab ID: 208827-1 METHOD			ecvd: 07,		Sample	Date: 07/30/2	003	
3010A	DESCRIPTION			PREP BT	#(S)	DATE/TIME A		DILUTIO
SW846 7196 MCP	Acid Digestion, Total (ICP) MCP	1	15813			08/05/2003	0800	
		1	15766			07/31/2003	1503	5
SW846 6010B	Metals Analysis Trace (ICP)	1	15928	15813		08/06/2003	1513	
	QC Metals Report, Level 2	1	16099			08/12/2003	1540	
0440 ZE005	QC Wet Chemistry Report, Level 2	1	15919			08/06/2003	0000	
SM18 3500D	Trivalent Chromium	1	16098			08/12/2003	1510	
Lab ID: 208827-2		Date R	ecvd: 07/	/31/2003	Sample	Date: 07/30/20	003	
METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT	#(S)	DATE/TIME AN	ALYZED	DILUTION
3010A	Acid Digestion, Total (ICP) MCP	1	15813			08/05/2003	0800	
SW846 7196 MCP		1	15766			07/31/2003	1506	2
SW846 6010B	Metals Analysis Trace (ICP)	1	15928	15813		08/06/2003	1519	-
SM18 3500D	Trivalent Chromium	1	16098	13013		08/12/2003	1510	
Lab ID: 208827-3	Client ID: Bf7	Date Pa	ecvd: 07/	31/2003	Sample.	Date: 07/30/20	107	
METHOD	DESCRIPTION	DI N#	RATCU#	PREP BT	#/C/			DILLITA
3010A	Acid Digestion, Total (ICP) MCP	1	15813	FREP DI	#(3)	DATE/TIME AN		DILUTION
	-Hexavalent Chromium					08/05/2003	0800	_
SW846 6010B	Metals Analysis Trace (ICP)	1	15766	45047		07/31/2003	1507	2
SM18 3500D	Trivalent Chromium	1 1	15928 16098	15813		08/06/2003	1525	
		•	10076			08/12/2003	1510	
Lab ID: 208827-4	Client ID: Bf8		cvd: 07/		Sample	Date: 07/30/20	03	
METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT	#(S)	DATE/TIME AN	ALYZED	DILUTION
3010A	Acid Digestion, Total (ICP) MCP	1	15813			08/05/2003	0800	
	Hexavalent Chromium	1	15766			07/31/2003	1507	2
SW846 6010B	Metals Analysis Trace (ICP)	1	15928	15813		08/06/2003	1532	_
SM18 3500D	Trivalent Chromium	1	16098			08/12/2003	1510	
ab ID: 208827-5	Client ID: Bf4s	Date Re	cvd: 07/	31/2003	Sample	Date: 07/30/20	03	
METHOD	DESCRIPTION	RUN#		PREP BT	#(5)	DATE/TIME AN		DILUTION
3010A	Acid Digestion, Total (ICP) MCP	1	15813	TREE DI	<i>#</i> (0)	08/05/2003	0800	DILUTION
SW846 7196 MCP	Hexavalent Chromium	i	15766					2
SW846 6010B	Metals Analysis Trace (ICP)	1		15813		07/31/2003	1508	2
SW846 6010B	Metals Analysis Trace (ICP)	-				08/06/2003	1538	2
SW846 6010B	Metals Analysis Trace (ICP)	1	15962	15813		08/07/2003	1126	5
SM18 3500D		1	16090	15813		08/12/2003	1017	10
עטטככ מוויינ	Trivalent Chromium	1	16098			08/12/2003	1510	
ab ID: 208827-6	Client ID: Bf5s	Date Re	cvd: 07/3	31/2003	Sample	Date: 07/30/20	03	
METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT	#(S)	DATE/TIME AN	ALYZED	DILUTION
3010A	Acid Digestion, Total (ICP) MCP	1	15813			08/05/2003	0800	
	Hexavalent Chromium	1	15766			07/31/2003	1509	2
SW846 6010B	Metals Analysis Trace (ICP)	1	15928	15813		08/06/2003	1544	2
SW846 6010B	Metals Analysis Trace (ICP)	1	16090	15813		08/12/2003	1023	10
SM18 3500D	Trivalent Chromium	i	16098	1,50,5		08/12/2003	1510	10
ab ID: 208827-7	Client ID: Bf7s	Nata Pa	cvd: 07/3	11/2007	Comple	Data 07/70/20	n#	
METHOD	DESCRIPTION			PREP BT		Date: 07/30/200		DILUTION
	Acid Digestion, Total (ICP) MCP			PREP DI	#(3)	DATE/TIME ANA		DILUTION
SW846 7196 MCP	Hexavalent Chromium	1	15813			08/05/2003	0800	_
	Metals Analysis Trace (ICP)	1	15766	45047		07/31/2003	1510	2
SM18 3500D	Trivalent Chromium	1	15881	15813		08/05/2003	1903	
מטטכב סו מס	nivatent unromium	1	16098			08/12/2003	1510	
ab ID: 208827-8	Client ID: Bf8s	Date Red	vd: 07/3	1/2003	Sample I	Date: 07/30/200	3	
METHOD	DESCRIPTION			PREP BT		DATE/TIME ANA		DILUTION
3010A	Acid Digestion, Total (ICP) MCP	1	15813			08/05/2003	0800	
						,,		





LABORATORY CHRONICLE

Job Number: 208827

Date: 08/12/2003

			· · · · · · · · · · · · · · · · · · ·		*************	
emical	PROJECT: FLOC S	AMPLING		ATTN: Alan Pei	rc e	
Client ID: Bf8s	Date Re	cvd: 07/	/31/2003 Samp	ole Date: 07/30/20	003	
DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME A	IALYZED	DILUTION
Hexavalent Chromium	1	15766		07/31/2003	1511	2
Metals Analysis Trace (ICP)	1	15928	15813	08/06/2003		
Trivalent Chromium	1	16098		08/12/2003	1510	
Client ID: Bfsws					003	
DESCRIPTION	RUN#		PREP BT #(S)	•		DILUTION
	P 1			,		
	1			• •		2
Metals Analysis Trace (ICP)	1			• •		2
	1		15813			100
Trivalent Chromium	1	16098		08/12/2003	1510	
Client ID: Bfws	Date Re	cvd: 07/	/31/2003 Samp	ole Date: 07/30/20	003	
DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME AN	IALYZED	DILUTION
	2 1	15813		08/05/2003	0800	
Hexavalent Chromium	1	15766		07/31/2003		2
Metals Analysis Trace (ICP)	1	15962		08/07/2003		
Metals Analysis Trace (ICP)	1		15813			100
Trivalent Chromium	1	16098		08/12/2003	1510	
Client ID: Backfloc	Date Re	cvd: 07/	31/2003 Samp	ole Date: 07/30/20	003	
DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME AN	IALYZED	DILUTION
Acid Digestion (ICP) Solids	1	16017		08/11/2003	0800	
Alkaline Digestion for CR6	1	15917		08/06/2003		
Hexavalent Chromium	1	15918		08/06/2003		
Metals Analysis Trace (ICP)	1	16090	16017	08/12/2003	1156	5
Metals Analysis Trace (ICP)	1	16091	16017	08/12/2003	1156	5
Trivalent Chromium	1	16098		08/12/2003	1510	
	DESCRIPTION Hexavalent Chromium Metals Analysis Trace (ICP) Trivalent Chromium Client ID: Bfsws DESCRIPTION Acid Digestion, Total (ICP) MCI Hexavalent Chromium Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Trivalent Chromium Client ID: Bfws DESCRIPTION Acid Digestion, Total (ICP) MCI Hexavalent Chromium Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Trivalent Chromium Client ID: Backfloc DESCRIPTION Acid Digestion (ICP) Solids Alkaline Digestion for CR6 Hexavalent Chromium Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP)	Client ID: Bf8s Date Re DESCRIPTION RUN# Hexavalent Chromium 1 Metals Analysis Trace (ICP) 1 Trivalent Chromium 1 Client ID: Bfsws Date Re DESCRIPTION RUN# Acid Digestion, Total (ICP) MCP 1 Hexavalent Chromium 1 Metals Analysis Trace (ICP) 1 Inivalent Chromium 1 Client ID: Bfws Date Re DESCRIPTION RUN# Acid Digestion, Total (ICP) MCP 1 Trivalent Chromium 1 Client ID: Bfws Date Re DESCRIPTION RUN# Acid Digestion, Total (ICP) MCP 1 Hexavalent Chromium 1 Metals Analysis Trace (ICP) 1 Inivalent Chromium 1 Client ID: Backfloc Date Re DESCRIPTION RUN# Acid Digestion (ICP) Solids 1 Alkaline Digestion for CR6 1 Hexavalent Chromium 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1 Metals Analysis Trace (ICP) 1	Client ID: Bf8s Date Recvd: 07, DESCRIPTION Hexavalent Chromium Client ID: Bfsws Client ID: Bfsws Date Recvd: 07, DESCRIPTION Client ID: Bfsws Date Recvd: 07, DESCRIPTION Acid Digestion, Total (ICP) MCP Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Client ID: Bfws Date Recvd: 07, Metals Analysis Trace (ICP) Trivalent Chromium Client ID: Bfws Client ID: Bfws Date Recvd: 07, DESCRIPTION RUN# BATCH# Acid Digestion, Total (ICP) MCP Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Metals Analysis Trace (ICP) Trivalent Chromium Client ID: Backfloc Date Recvd: 07, DESCRIPTION RUN# BATCH# Acid Digestion (ICP) Solids Alkaline Digestion for CR6 Alkaline Digestion for CR6 Alkaline Digestion for CR6 Metals Analysis Trace (ICP) Metals Analysis Trac	Client ID: Bf8s	Client ID: Bf8s	Client ID: Bf8s



QUALITY CONTROL RESULTS

JOB NUMBER: CLIENT:

208827

OLIN

208827-1 Units:mg/Kg

208709-9 Units:mg/Kg

Analyte	Sample Identification	MB RL	Sample RL	Sample Result	Spike Conc.	Matrix Spike	MS % Réc	Spike Dup	MSD % Rec	وما استعداد	Q	Spike Limits		LCS Found	LCS % Rec	LOS QC	The second second
Hexavalent Chrom	208827-1	0.1U	0.1U	0.00	0.125	0.11	88	0.11	88	0		75-125		0.1	100		Analyze 07/31/0:
Hexavalent Chrom	208708-9	0.2U	0.95U	0.0	42.9	33.4	77.9					75-125	39.3	31.9	81.2	80-120	08/06/03
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STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707

QUALITY CONTROL RESULTS

Job Number:

208827

Client: C

Olin

Units: ug/L

Extraction Batch: 15813

Analytical Batch: 15881, 15928

The state of the second	QC Sample		Sample	Sample	Sample		Spike	Matrix	MS %		Spike,	LCS	LCS	LCS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc	Spike	Rec	Q.	Limits	TRUE	found	% Rec C	Limits	Analyżed
Aluminum	208827-7	100U	100	267	262	2	1000	1379	111		70-130	1000	1059	106	85-115	8/5/03
Chromium	208827-7	10U	10	1919	2061	7	500	2486	113		70-130	500	505	101	85-115	8/5/03
Iron	208827-7	100U	100	156000	167000	7	500	16100	0	*	70-130	500	515	103	85-115	8/5/03
Manganese	208827-7	20U	20	3400	3640	7	500	3985	117		70-130	500	509	102	85-115	8/5/03
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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD

NY DOH 10843 NH DES 253901-A NELAP NY 10843



STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707 STL Billerica 149 Rangeway Rd. Billerica, MA 01862 Tel:(978) 667-1400 Fax(978) 667-7871 RPD =≤20

QUALITY CONTROL RESULTS SW846 6010/7471

Job Number: 208827 Client:

Olin Chemical

Units: mg/kg

Extraction Batch: 16017

16090, 16091

i wykana a nakazana B	QC Sample	MB	Sample	Sample	Sample	13.7	Spike	Matrix	MS %	sand Marie	Spike	LCS	LCS	LCS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc.	Spike	Rec	Q	Limits	TRUE	found	% Rec Q	Limits	Analyzed
											75-125	W	,		80-120	,, , ,,,
Aluminum	209032-1	5U	5	6485.8	8464.8	26	69.6	6442.6	0	*	75-125	1000	1002	100	80-120	8/12/03
Chromium	209032-1	10	1	7.9	14.4	58	34.8	39.4	90		75-125	500	474	95	80-120	8/12/03
Iron	209032-1	5U	5	6333.0	10754.4	52	34.8	6526.2	555	*	75-125	500	536	107	80-120	8/12/03
Manganese	209032-1	1U	1	51.2	104.2	68	34.8	89.8	111		75-125	500	472	94	80-120	8/12/03
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MADEP MA014 RIDOH57

NY DOH 10843 CTDPH 0494 NH DES 253901-A VT DECWSD **NELAP NY 10843**



STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707

STL Billerica-Service Center 149 Rangeway Rd. Billerica, MA 01862 Tel:(978) 667-1400 Fax(978) 667-7871

RPD=≤20

rpjsckl Job Sample	Receipt Checkli	st Report	V2
		Description.: : Alan Peirce	Date of the Report: 07/31/2003 Project Manager: bcm
Questions ? (Y/	(N) Comments		
Chain-of-Custody Present?	,		
If "yes", completed properly?	,		
Custody seal on shipping container? N			
If "yes", custody seal intact?			
Custody seals on sample containers? N			
If "yes", custody seal intact?			
Samples iced? Y			
Temperature of cooler acceptable? (4 deg C +/- 2). N			
Temperature at receipt	11.3C		
Samples received intact (good condition)? Y			
Volatile samples acceptable? (no headspace)			
Is a Trip Blank required?			
Was a Trip Blank provided?			
Correct containers used? Y			
Adequate sample volume provided? Y			
Samples preserved correctly?			
Samples received within holding-time? Υ			
Agreement between COC and sample labels? Υ			
Comments			
If samples were shipped was there an air bill $\#?\ Y$	835812325335		> //
Sample Custodian Signature/Date	MJB 07/31/03	Wente !	egre 7/31/03

Severn Trent Laboratories, Inc.Chain of Custody Form



02589 208827 •53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 •149 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871

Client: Olin Geomego	Inc.		. P	roject #:	Ç0.	330	3F	(.(loc	SH	udy)	Job#	10,11) () (data		Quet	e#	STL-BILLERICA PO#
Address: 2995 Baseline			Project M	lanager:	Ĭ,	an	Sh	sve			0			aded Ana	Section Charles	Control of the	off	iće u	se	Comments
Boulder, CO.	80303		.,	Work ID:									Check	c analy	sis ar	nd spe	ecify	meth	bc	(Special Instructions)
Phone: 303443 9117 Fax:	<i>3</i> 03938	8123	· · · · · · · · · · · · · · · · · · ·	Contact:	Do	<u> </u>	for	<u>e/(</u>	rain	R.,	Walk	علا	For ex						٦.	Analyte list:
Requested Turn Around			Regulatory C								rmat			0-serie 0-serie				er		
10 Business Day (Std) Rush 15 Business Day 24 hrs			NPDES RCRA	Drinki	ng vv	ater _		_ DE	P Forn	1(S)		-	80	00-seri	es for l	naz/so	lid wa			- EPA method 200.7
	s 5 Day		Other	- WCF	GVVI	31 -			P QA/				Use co	mment	s secti	on to f	urthe	r defin	ъ. ф	
Sample Type Codes	<u> </u>					$\overline{\mathbf{T}}$						$\overline{}$			1	: [Г	1,	<u>13</u>	Chromium Total
WW-Wastewater DW-Drinking water		er			[9	<u> </u>			<u></u>		8 24		ď	3	200	≨ {}			ઇ ફ્રે	Ornardan 1
LW-Labwater GW-Groundwater A S-Solid / Soil SL-Sludge O-Oil	A-Air Z-Other				1	딩	0	ן נוצ	7		4 %	ایا	5 5		۔ ا	įįį	<u>_</u>	:	Conne	Chromium trivalent
		ι _ν		Grab Comp.	S S	NaHSO4/MeOH	HNO3 to pH	티오	NaOH to pH >12 Na2S2O3	ပ္	82 2	625	8 8	EPH / VPH	띯	밁뢵	gi		ase ase	Aluminum
Sample ID	<u>@</u>	Sampler's Initials	Date	_	igi (Š Q	12 3	취취	위	~ .	<u>8</u> 8	Semivoa	, å	:[<[ن ا س	힐	흲	ا ج		Alundivider
Jan., p. 0 . 2	Sample Type	itials	Time	ag di	ខ្លាំ				힏쫎	ne:	ati at	اڠۣٳ		티포티	힕	g j	뫓	Xici	ब्रुं ह	Iron
	<u>%</u> F	ဖြင့်	Collected	<u>ज</u> ं ठ	# å	ž	도 :	리포	ž ž	ž,	<u> </u>	NS I	<u>% </u> jg	(造		<u> </u>	8	유	<u> </u>	Manganese
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B-f.5		1	7 30 03		1 8	P				7									7	1 -20
हर न			7 30 03	130	i f	'n				4									ı	- EPA method 7196a
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BS4S			7 30 03		1 8	ì				1									,	1
B(28			7 30 03	15/5	-)				٧									V	<i>}</i>
B#12			7/30/03	0	1 1)				/									,	1
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Bfws	r	r	7/30/03		1 8	ì				Y									١,	0.1 ym
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Relinquished by:		Date:	Tiı	ne:	Rece	eived	by:	VO (II	<u> WW</u>		yen.	<u> </u>	Date	> \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	<u>د</u> پر		ne:	<u>V.V</u>		
Method of shipment:					Si	ΓL-	We	est	fiel	d								·		Preservation/pH.ohecked By: <i>M/</i> ち Date: ナ/きょんろ

Severn Trent Laboratories, Inc.Chain of Custody Form



02591 208827 •53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 stl-westfield •149 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Olin Geomega		Proje	ect #: <u>(</u>	03	303 F	"fl	oc Sh	udy!				14,120		Will Assessed	A SECTION OF THE SECT	PO#
Address: 2995 Baseline A	d Ste 20	2 Project Man	ager:	Dar	· St	one				1. (MILES OF BUILDING	aded a Analy	25.00	-			Comments
Boulder, CO 8030	3	Wor	k ID:							Check	analysi	is and	speci	fy met	hod	(Special Instructions)
Phone: 303443 9117 Fax: 303		_ Cor	ntact: I	an i	Stone	100	i. 2	المال.	4	and ar	nalytes i imple:	in com	ment	s secti	on.	
Requested Turn Around Time		Regulatory Clas	sificatio	on	/ Sp	ecial I	₹eport	Forma	at		D-series 1 D-series 1					EPA method 200.7
10 Business Day (Std) Rush TAT Red		NPDES								80	00-series	for ha	z/solid	waste	~h	
15 Business Day 24 hrs Other 48 hrs		RCRA ———Other	MCP GV	N1/S			'RA Sm P QA/C		-	Use co	mments	section	to furt	her def	ine.	Chromium Total
Other 48 hrs Sample Type Codes	J Day	Other							<u> </u>	 	П	<u> </u>			ाई	Chromital
WW-Wastewater DW-Drinking water SW-Surfa	acewater			(<u>0</u>		ا ال	<u></u>	 624	8021			28	ξį		/ TOC	Chronium Trivalent
LW-Labwater GW-Groundwater A-Air S-Solid / Soil SL-Sludge O-Oil Z-Other			"	Slas	꽃 [상]	¥ _	<u> </u>	7 2 3	2 S	270 ticio	- -		ig 3	Ę		
		- 	Jer	ō	ᇍ	합기	필입	5.	26 29	Pes 8			5	<u>ğ</u>	الا <u>a</u> ع	Maminum
Sample ID	apler sts	<u>Date</u> Time	io.	ic(P	3 tc	2 B	SSI		itiles ivo	_ <u>اقِّا</u>	_ ;) SE	eral	e €	الرِّ إِنَّ إِنَّ	Iron
-	Sample Type Sampler's Initials	Collected	Grab Comp. # Containers	Plastic(P) or Glass	R E	된 <u>무</u>	Na2 Na2	None / 4° C Volatiles 524 / 624	Volatiles 8260 Semivoa 625	Sem	EPH / VPH	Met	Gen	Bacteriological Toxicity	Oil & Grease	Manganese
Backfloc	S Ow	7/30/03		ρ			$\perp \downarrow \downarrow$	4								Manganese EPA method 7196a Chromium Hexavalent
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					\dashv									-		Chromium Hexavalent
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Tromquisited by.	Jan		['`		7	Utan	HT)	75,	med	P .	7-30	-53	3 1	04	0	Tempr@ receipt: 103 °C
Relinquished by:	Date	e: Time:	R	lecei	ed by:		7-			Date			Tim	e:		Preservation/pH/checked // //
Method of shipment:				ST	L-W	'est	fiel	d								By: W.S. Date: 7/30/03



STL Westfield 53 Southampton Road Westfield, MA 01085

Tel: 413 572 4000 Fax: 413 572 3707 www.stl-inc.com

Alan Peirce Olin Chemical 51 Eames Street Wilmington, MA 01887

11/06/2003

Report Number: 210882

Dear Alan Peirce,

The analysis of your sample(s) submitted on 10/23/2003 is now complete and the appropriate analytical report is enclosed. The samples were prepared and analyzed according to established methodologies and protocols. All holding times were met for the methods performed on these samples, unless otherwise noted in the report's case narrative.

If you have any questions regarding this report, please contact your project manager. If you have questions, concerns or comments regarding our service, please do not hesitate to contact me directly.

Thank you for selecting STL-Westfield, and we look forward to working with you on future projects.

Steven C. Hartmann Laboratory Director STL Westfield

Technical Review: ST 11/6/03

Total number of pages in this report: ∂

ANALYTICAL REPORT

JOB NUMBER: 210882

Prepared For:

Olin Chemical 51 Eames Street Wilmington, MA 01887

Attention: Alan Peirce

Date: 11/06/2003

Signature

Name: Rebecca C. Mason

Title: Project Manager

E-Mail: bmason@stl-inc.com

Westfield Executive Park

53 Southampton Road Westfield, MA 01085

PHONE: 413-572-4000 FAX..: 413-572-3707







	MADE	P MCP An	alytical Metho	d Repor	t Certi	ficatio	n Form		
Laboratory I	Name:	Severn Tre	nt Laboratory (S	TL) West	field	Project #	±: 2·	10882)
Project Loca	ation:				MAC	EP RTN1	:		
This form po 210882-1-6		cations for the fo	ollowing data set:[list l	Laboratory S	Sample ID	Number	(s)]		
					 				
Sample Mat		Groundwater	Soil/Sedime	ent 30 ()	Drinking V 6010B (Other: 0A/1A ()	Othe	\
MCP SW-8		8260B() 8270C()	, ,	PH()	6020 ($\frac{6M^2()}{4M^2()}$	Otne	er (x)
Methods (useu d in MADEP	8082 ()	, ,	PH()	7000 S ³	' '	6A(x)	-	
Compendiu Analytical M check all fr	im of Methods:	1 List Release 2 M - SW-846	e Tracking Number (F 6 Method 9014 or MAI 6 Methods 7000 Series	RTN), if known DEP Physio	logically A	vailable (Cyanide (PA	.C) Met	thod
An affirmat	tive response	e to questions	A, B, C and D is requ	uired for "P	resumpti	ve Certai	inty" status	;	
			the laboratory in a co f-Custody documenta				(Ýe	s)	No ¹
В	included in thi	s report follower arrative QC data	required for the specit d, including the requir a that did not meet ap	ement to no	te and		Ye	\$)	No ¹
C	for "Presumpt document CA	ive Certainty", a M VII A, " Qualit	ded in this report meens described in Section ty Assurance and Quarting of Analytical Data	n 2.0 of the ality Control	MADEP		Ye	D N/.	A No ¹
–			y: Was the VPH or EF		run withou	ıt	Ye	s (N	A No
	A response	e to questions	E and F below is rec	quired for "	Presump	tive Certa	ainty" statu	ıs	
		performance sta hods achieved?	indards and recomme	endations fo	r the		Ye	s No	
1	Were results method(s) rep	•	st compounds/elemen	its for the sp	ecified		Ye	s N	/A N o
<u>+</u>	` ` '		be addressed in an att	tached Envi	ronmenta	Laborato	ory case nar	rative.	
		·	ins and penalties of						
	-		ning the information						
nalytical r	report is, to t	he best of my k	nowledge and belie	f, accurate	and com	plete.			
;	Signature:	Str	Hartu	•	Posi	tion: <u>Lat</u>	ooratory Di	rector	
Р	Printed Name	: Steven C. Ha	artmann	<u>-</u>	I .	Date:	11/6/0	3	
					STL Westfield	- 54	STL Bille	erica	

SEVERN STL

MADEP MA014 RIDOH57

CTDPH 0494 VT DECWSD NY DOH 10843 NH DES 253901-A NELAP NY10843



STL Westfield 53 Southampton Rd, Westfield, MA 01085 Tel:(413)572-4000 Fax:(413)572-3707 STL Billerica 149 Rangeway Rd N.Billerica, MA 01862 Tel:(978)667-1400 Fax:(978)667-7871

MCP CASE NARRATIVE

Client: OLIN

Report Number: 210882

This case narrative is in the form of an exception report, where only the anomalies related to this report, method specific performance and/or QA/QC issues are discussed. If there are no issues to report, this narrative will include a statement that documents that there are no relevant data issues as stipulated in the MCP reporting requirements.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

The project samples were received on 10/23/03; the samples arrived in good condition and on ice. The samples arrived unpreserved and were preserved upon arrival at the laboratory.

SW846 6010B

At the request of the client, an abbreviated MCP analyte list was reported for this job.

Poor matrix spike recovery was noted for the MS results for Aluminum, Chromium and Iron. The sample concentrations overwhelmed the amount of spike added. The LCS recovered within acceptable control limits for each analyte.

An ICSA/AB solution, which monitors spectral interference, was not performed at the end of the analytical instrument run as per method 6010MCP. An initial ICSA/AB standard was performed and met all criteria established in 6010MCP

An aqueous based LCS was substituted for this job and brought though the entire preparation process. The LCS met MCP method recovery control specifications.

There were no additional QA/QC deviations or issues reported for this method.

SW846 7196

The percent recovery for the MS,MSD samples in the aqueous Hexavalent chromium analysis were outside of method limits, matrix interference is presumed. The LCS recovered within acceptable limits.

There were no additional QA/QC deviations or issues reported for this method.

The following reported methods are not listed in the MADEP Massachusetts Contingency Plan (MCP) Compendium of Analytical Methods (CAM), pursuant to the provisions of 310 CMR 40.0017(2).

Metals EPA 200.7

There were no QA/QC deviations or issues reported for this method.

QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 11/06/2003

STL WESTFIELD
DATA REPORTING QUALIFIERS AND TERMINOLOGY

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The majority of the qualifiers have evolved from the EPA Contract Laboratory Program (CLP).

Report Comments:

All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.

Soil, sediment and sludge sample results are reported on a "dry weight" basis.

Reporting limits are adjusted for sample size used, dilutions and moisture content, if applicable.

The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert.ID# 10843.

STL-Westfield Certifications: MADEP MA014, CT DPH 0494, NH DES 253901-A, NY DOH 10843, RI DOH 57, VT DECWSD.

According to 40CFR Part 136.3, pH, Total Residual Chlorine and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field analyses, they were not analyzed immediately, but as soon as possible on laboratory receipt.

Analytical result(s) reported as "ND", indicates that the analyte was analyzed for but "not detected."

Analytical result(s) reported as "TNTC" indicates that the microbiological test was "too numerous to count."

Glossary of Qualifiers:

Inorganic Qualifiers (Q-column):

U Indicates that the analyte was analyzed for but not detected.

- E Indicates an estimated value due to the presence of interference. When applied to GFAA analysis, indicates the one-point method of addition recovered between 40-85 percent.
- B Indicates an estimated result value. The result was measured between the reporting limit and the method detection limit (MDL).

Organic Qualifiers (Q-column):

U Indicates that the compound was analyzed for but not detected.

- J Indicates an estimated result value. This qualifier is used when mass spectral data indicated the presence of a compound that meets the identification criteria and the result is less than the specified quantitation limit, but greater than the method detection limit (MDL).
- B Indicates that the compound was found in both the sample and its associated laboratory blank. Indicates possible/probable blank contamination and warns the data user to exercise caution when applying the results to this compound.

D Indicates all compounds identified in an analysis at a secondary dilution factor.

E Indicates that the compound in an analysis has exceeded the instrument linear calibration range.

Glossary of Terms:

Surrogates (Surrogate Standards): An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. For semi-volatiles and pesticides/Arochlors, surrogate compounds are added to every blank, sample, matrix spike, matrix spiked duplicate, matrix spike blank (LCS), and standard. These compounds are used to evaluate analytical efficiency by measuring recovery. Poor surrogate recovery may indicate a problem with the sample composition.









QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 11/06/2003

- Internal Standard: An organic compound, which is similar to the target analyte(s) in chemical composition and behavior in the analytical process. For GC/MS semi-volatiles and volatiles, internal standards are added to every blank, sample, matrix spike, matrix spike duplicate, matrix spike blank (LCS), and standard. Internal standard responses outside of established limits will adversely affect the quantitation and final concentration of target compounds.
- Matrix Spike (MS): An aliquot of a sample (water or soil) fortified (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for matrix interference by measuring recovery. The spiking occurs prior to sample preparation and analysis. Poor spike recovery may indicate a problem with the sample composition.
- Laboratory Control Sample (LCS): An aliquot of analyte-free reagent water or sand fortifed (spiked) with known quantities of specific compounds (target analytes) and subjected to the entire analytical procedure in order to indicate the appropriateness of the method efficiency.
- Blank: An artificial sample of analyte-free water or solvent, designed to monitor the introduction of contaminates into the analytical process.
- Method Dectection Limit (MDL): The minimum concentration of an analyte or compound that can be measured and reported with 99% confidence that the result concentration is greater than zero.

Petroleum Hydrocarbon Comments:

The following comments are specific to Diesel Range Organics (DRO), by GC/FID:

- Results for DRO are based on chromatographable portions of the petroleum product. The Carbon Range refers to the approximate chromatographic region covered by the specified petroleum product in straight-chain carbon units between C9-C36.
- Quantitation is based on the average response factors for a series of hydrocarbons standards. The sample result from the DRO fraction is independent of the target compound assignment.
- Samples yielding chromatographic patterns that do not agree with any of the method targets are reported as "unmatched".







NY DOH 10843



SAMPLE 1 N F O R M A T 1 O N Date: 11/06/2003

Job Number .: 210882 Customer...: Olin Chemical Attn....: Alan Peirce

Project Number.....: 20001846
Customer Project ID...: 302A C03
Project Description...: 302A/C03

Laboratory	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
210882-1	WF3	Water	10/22/2003	13:00	10/23/2003	10:11
210882-2	WF4	Water	10/22/2003	13:15	10/23/2003	10:11
210882-3	WF5	Water	10/22/2003	13:30	10/23/2003	10:11
210882-4	WF7	Water	10/22/2003	13:50	10/23/2003	10:11
210882-5	WF8	Water	10/22/2003	14:15	10/23/2003	10:11
210882-6	White Floc	Soil	10/22/2003	14:30	10/23/2003	10:11
						:





MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD



RESULTS LABORATORY TEST

Job Number: 210882

Date: 11/06/2003

CUSTOMER: Olin Chemical

PROJECT: 302A CO3

ATTN: Alan Peirce

Customer Sample ID: WF3 Date Sampled....: 10/22/2003 Time Sampled....: 13:00

Sample Matrix....: Water

Laboratory Sample ID: 210882-1
Date Received.....: 10/23/2003
Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TEC
SM18 3500D	Trivalent Chromium (Calc.), Diss.	1.43		0.010	mg/L	10/31/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	10/23/03	kmn
EPA 200.7	Metal Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Chromium (Cr), Diss. Manganese (Mn), Diss.	19700 3790 1430 5910		50.0 50.0 5.0 10	ug/L ug/L ug/L ug/L	10/31/03 10/30/03 10/30/03 10/30/03	bpg
						L	



LABORATORY TEST RESULTS

Job Number: 210882

Date: 11/06/2003

CUSTOMER: Olin Chemical

PROJECT: 302A C03

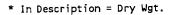
ATTN: Alan Peirce

Customer Sample ID: WF4
Date Sampled....: 10/22/2003

Time Sampled....: 13:15
Sample Matrix....: Water

Laboratory Sample ID: 210882-2 Date Received.....: 10/23/2003 Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	0	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	2.18		0.010	mg/L	10/31/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	υ	0.0050	mg/L	10/23/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Chromium (Cr), Diss. Manganese (Mn), Diss.	23200 45900 2180 6360		50.0 50.0 5.0 10	ug/L ug/L ug/L ug/L	10/31/03 10/30/03 10/30/03 10/30/03	bpg bpg
						4. da. da.	i i
	,						





RESULTS TEST LABORATORY

Job Number: 210882

Customer Sample ID: WF5
Date Sampled....: 10/22/2003

Time Sampled....: 13:30 Sample Matrix...: Water

Date: 11/06/2003

CUSTOMER: Olin Chemical

PROJECT: 302A CO3

ATTN: Alan Peirce

Laboratory Sample ID: 210882-3 Date Received.....: 10/23/2003 Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TE
SM18 3500D	Trivalent Chromium (Calc.), Diss.	0.060		0.010	mg/L	10/31/03	bp
1846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	10/23/03	kr
EPA 200.7	Metal Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Chromium (Cr), Diss. Manganese (Mn), Diss.	348 ND 62 5970	U	50.0 50.0 5.0 10	ug/L ug/L ug/L ug/L	10/31/03 10/30/03 10/30/03 10/30/03	b
				-			



RESULTS LABORATORY TEST

Job Number: 210882

Date: 11/06/2003

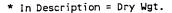
CUSTOMER: Olin Chemical

PROJECT: 302A CO3

ATTN: Alan Peirce

Customer Sample ID: WF7 Date Sampled....: 10/22/2003
Time Sampled....: 13:50
Sample Matrix....: Water Laboratory Sample ID: 210882-4
Date Received.....: 10/23/2003
Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	υ	0.010	mg/L	10/31/03	
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	U	0.0050	mg/L	10/23/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Chromium (Cr), Diss. Manganese (Mn), Diss.	ND ND 6 32	U	50.0 50.0 5.0 10	ug/L ug/L ug/L ug/L	10/31/03 10/30/03 10/30/03 10/30/03	bpg bpg







LABORATORY TEST RESULTS

Job Number: 210882

Date: 11/06/2003

CUSTOMER: Olin Chemical

PROJECT: 302A CO3

ATTN: Alan Peirce

Customer Sample ID: WF8
Date Sampled.....: 10/22/2003
Time Sampled.....: 14:15
Sample Matrix....: Water

Laboratory Sample ID: 210882-5 Date Received.....: 10/23/2003

Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS		TECH
SM18 3500D	Trivalent Chromium (Calc.), Diss.	ND	U	0.010	mg/L	10/31/03	bpg
SW846 7196 MCP	Hexavalent Chromium, Diss.	ND	u	0.0050	mg/L	10/23/03	kmm
EPA 200.7	Metal Analysis (ICP) Aluminum (Al), Diss. Iron (Fe), Diss. Chromium (Cr), Diss. Manganese (Mn), Diss.	ND ND ND ND	כטטט	50.0 50.0 5.0 10	ug/L ug/L ug/L ug/L	10/31/03 10/30/03 10/30/03 10/30/03	bpg



LABORATORY TEST RESULTS

Job Number: 210882

Date: 11/06/2003

CUSTOMER: Olin Chemical

PROJECT: 302A CO3

ATTN: Alan Peirce

Customer Sample ID: White Floc Date Sampled....: 10/22/2003 Time Sampled....: 14:30 Sample Matrix...: Soil Laboratory Sample ID: 210882-6 Date Received.....: 10/23/2003 Time Received.....: 10:11

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	REPORTING LIMIT	UNITS	DATE	TECH
SM18 3500D	Trivalent Chromium (Calc.)	21700		1.00	mg/Kg	11/06/03	bpg
SW846 7196 MCP	Hexavalent Chromium*	2080		21	mg/Kg	11/05/03	rwe
% Solids 160.3	% Solids	9.4		0.1	%	10/31/03	grb
SW846 6010B	Metals Analysis (ICP) Iron (Fe)*	89100		96.1	mg/Kg	10/28/03	bpg
SW8466010B MCP	Metals Analysis Trace (ICP) Chromium (Cr)*	23800		48.1	mg/Kg	10/28/03	bpg
SW846 6010B	Metals Analysis Trace (ICP) Manganese (Mn)* Aluminum (Al)*	612 101000		48.1 481	mg/Kg mg/Kg	10/28/03 10/28/03	bpg bpg

* In Description = Dry Wgt.



LABORATORY CHRONICLE

Job Number: 210882

Date: 11/06/2003

CUSTOMER: Olin Ch	emical	PROJECT: 302A C	03	j	NTTN: Alan Peirce	
Lab ID: 210882-1 METHOD SW846 7196 MCP EPA 200.7 EPA 200.7	Client ID: WF3 DESCRIPTION Hexavalent Chromium Metal Analysis (ICP) Metal Analysis (ICP)	RUN# 1 1 1	19576 194		Date: 10/22/2003 DATE/TIME ANALYZED 10/23/2003 10/30/2003 1736 10/31/2003 1018	DILUTION
SM18 3500D	QC Metals Report, Level 2 QC Wet Chemistry Report, Level 2 Trivalent Chromium	1 1 1	19544 19839 19542		10/31/2003 0905 11/05/2003 0000 10/31/2003 0850	
Lab ID: 210882-2 METHOD SW846 7196 MCP EPA 200.7 EPA 200.7 SM18 3500D	Client ID: WF4 DESCRIPTION Hexavalent Chromium Metal Analysis (ICP) Metal Analysis (ICP) Trivalent Chromium				Date: 10/22/2003 DATE/TIME ANALYZED 10/23/2003 10/30/2003 1739 10/31/2003 1021 10/31/2003 0850	DILUTION
Lab ID: 210882-3 METHOD SW846 7196 MCP EPA 200.7 EPA 200.7 SM18 3500D	Client ID: WF5 DESCRIPTION Hexavalent Chromium Metal Analysis (ICP) Metal Analysis (ICP) Trivalent Chromium				Date: 10/22/2003 DATE/TIME ANALYZED 10/23/2003 10/30/2003 1742 10/31/2003 1024 10/31/2003 0850	DILUTION
Lab ID: 210882-4 METHOD SW846 7196 MCP EPA 200.7 EPA 200.7 SM18 3500D	Client ID: WF7 DESCRIPTION Hexavalent Chromium Metal Analysis (ICP) Metal Analysis (ICP) Trivalent Chromium				Date: 10/22/2003 DATE/TIME ANALYZED 10/23/2003 10/30/2003 1745 10/31/2003 1027 10/31/2003 0850	DILUTION
Lab ID: 210882-5 METHOD SW846 7196 MCP EPA 200.7 EPA 200.7 SM18 3500D	Client ID: WF8 DESCRIPTION Hexavalent Chromium Metal Analysis (ICP) Metal Analysis (ICP) Trivalent Chromium				Date: 10/22/2003 DATE/TIME ANALYZED 10/23/2003 10/30/2003 1749 10/31/2003 1030 10/31/2003 0850	DILUTION
Lab ID: 210882-6 METHOD % Solids 160.3 SW846 3050B MC		RUN# 1 1	ecvd: 10/23/ BATCH# PR 19604 19130	2003 Sample EP BT #(S)	Date: 10/22/2003 DATE/TIME ANALYZED 10/31/2003 0000 10/24/2003 0900	DILUTION
SW846 3060A SW846 7196 MCP SW846 6010B SW846 6010B SW8466010B MCP SM18 3500D	Alkaline Digestion for CR6 Hexavalent Chromium Metals Analysis (ICP) Metals Analysis Trace (ICP)	1 1 1 1 1	19386 19	130 130 130	11/05/2003 0000 11/05/2003 0000 10/28/2003 1509 10/28/2003 1534 10/28/2003 1534 11/06/2003 1341	10 10 50 50



MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD



QUALITY CONTROL RESULTS

Job Number: 210882 Client:

Olin

Units: µg/L

Extraction Batch: 19409

Analytical Batch: 19541, 19576

:	QC Sample	МВ	Sample	Sample	Sample		Spike	Matrix	MS %	Spike	LCS	LCS .	LCS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc.	Spike	Rec	Q Limits	TRUE	found	% Rec	 Limits	Analyzed
Aluminum	210980-1	20U	20U	500	522	4	1000	1403	90	75-125	1000	934	93	80-120	10/31/03
Chromium	210980-1	10U	10U	12.0	11.0	9	1000	882	87	75-125	1000	954	95	80-120	10/30/03
Iron	210980-1	50U	50U	130	129	1	1000	1036	91	75-125	1000	1048	105	80-120	10/30/03
Manganese	210980-1	10U	10U	0.0	0.0	0	1000	854	85	75-125	1000	944	94	80-120	10/30/03
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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD

NY DOH 10843 NH DES 253901-A NELAP NY 10843



STL Westfield 53 Southampton Rd. Westfield, MA 01085 Tel:(413) 572-4000 Fax(413) 572-3707

STL Billerica-Service Center 149 Rangeway Rd. Billerica, MA 01862 Tel:(978) 667-1400 Fax(978) 667-7871

RPD =<20

QUALITY CONTROL RESULTS SW846 6010/7471

Job Number: 210882 Client:

Olin

Units: mg/kg

Extraction Batch: 19130

Analytical Batch: 19387, 19386, 19382

	QC Sample	МВ	Sample	Sample	Sample	- 14 - 14 - 14 - 14 - 14 - 14 - 14 - 14	Spike	Matrix	MS %	- 1	Spike	LCS	LCS	LCS	LCS QC	Date
Analyte	Identification	RL	RL	Result	Duplicate	RPD	Conc.	Spike	Rec	Q	Limits	TRUE	found	% Rec. Q	Limits	Analyzed
												i				
Aluminum	210882-6	45U	45U	9442	9472	0	9.0	9175	0	*	75-125	1000	1112	111	80-120	10/28/03
Chromium	2108826	4.5U	4.5U	2241	2264	1	9.0	2179	0	*	75-125	1000	939	94	80-120	10/28/03
Iron	210882-6	9U	9U	8376	8317	1	9.0	8307	0	*	75-125	1000	1040	104	80-120	10/28/03
Manganese	210882-6	4.5U	4.5U	57.4	58.2	1	9.0	64.2	75		75-125	1000	956	96	80-120	10/28/03
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MADEP MA014 RIDOH57 CTDPH 0494 VT DECWSD

NY DOH 10843 NH DES 253901-A **NELAP NY 10843**



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STL Billerica-Service Center 149 Rangeway Rd. Billerica, MA 01862 Tel:(978) 667-1400 Fax(978) 667-7871

RPD=≤20

QUALITY CONTROL RESULTS

Job Number:

210882

Units: mg/L

Client:

Olin

									Q			LCS found			Date Analyzed
		0.00	0.25	0.03	14	0.06	23	51				0.05	96		
	:														
Identification	Identification RL	Identification RL RL	Identification RL RL Result	Identification RL RL Result Conc.	Identification RL RL Result Conc. Spike	Identification RL RL Result Conc. Spike Rec	Identification RL RL Result Conc. Spike Rec Dup	Identification RL Result Conc. Spike Rec Dup Rec	Identification RL RL Result Conc. Spike Rec Dup Rec RPD	Identification RL Result Conc. Spike Rec Dup Rec RPD Q	Identification RL Result Conc. Spike Rec Dup Rec RPD Q Limits	Identification RL Result Conc. Spike Rec Dup Rec RPD Q Limits TRUE	Identification RL Result Conc. Spike Rec Dup Rec RPD Q Limits TRUE found	Identification RL Result Conc. Spike Rec Dup Rec RPD Q Limits TRUE found % Rec	Identification RL Result Conc. Spike Rec Dup Rec RPD Q Limits TRUE found % Rec Q Limits

Comments: † = the quality control sample was run at a x10 dilution





Hexavalent Chromium in Soil (Alkaline Digestion) QC Summary

Date Digested =

05-Nov-03

Date Analyzed =

05-Nov-03

Analyst =

RWE

Sample Description	Result (mg/Kg)	Actual <u>Value</u>	%RPD	Acceptable % RPD Range	% Recovery	Acceptable M Recovery Range	Out of Range?
Prep Blank Soil	<0.050	<0.050	n/a	n/a	n/a	n/a	n/a
Laboratory Control Sample	30.9	38.2	n/a	n/a	80.9	80-120	No
Insoluble Spike #210882-6	18622.0	16536.0	n/a	n/a	100.4	75-125	No
Soluble Spike #210882-6	2810.0	839.0	n/a	n/a	94.9	75-125	No
Duplicate #210882-6	1899.0	n/a	9.00	0-20	n/a	n/a	No
#210882-6	2078.0	n/a	n/a	n/a	n/a	na/	n/a
Post Matrix Spike #210882-6	2190.0	8.420	n/a	n/a	105.0	85-115	No

NOTES:

After digestion and filtration, the samples were a pale, amber color without noticeable turbidity.

QUALITY CONTROL RESULTS

Job Number:

210882

Units: %

Client:

Olin

Analyte	QC Sample Identification	MB RL	Sample RL	\$66,000 \$200,000 (ACCOMPANIE)	Sample Duplicate		Date Analyzed
Percent solids	211037-1	n/a	n/a	92.40	89.70	3	10/31/03
		,					

 $RPD = \leq 20$





rpjsckl	Job Sample Receipt Checklist Report	V2
Job Number.: 210882 Location.: 57345 Customer Job ID: Project Number.: 20001846 Project Descrip	Check List Number.: 1 Description.: Job Check List Date.: 10/23/2003 ption.: 302A/C03 Contact.: Alan Peirce	Date of the Report: 10/23/2003 Project Manager: bcm
Questions ?	(Y/N) Comments	
Chain-of-Custody Present?	Y	
If "yes", completed properly?	Y	
Custody seal on shipping container?	Y	
If "yes", custody seal intact?	Y	
Custody seals on sample containers?	N	
If "yes", custody seal intact?		
Samples iced?	Y	
Temperature of cooler acceptable? (4 deg C	+/- 2). N	
Temperature at receipt	9.1c	
Samples received intact (good condition)?	Y	
Volatile samples acceptable? (no headspace))	
Is a Trip Blank required?		
Was a Trip Blank provided?		
Correct containers used?	Y	
Adequate sample volume provided?	Ү	
Samples preserved correctly?	Ү	
Samples received within holding-time?	Υ	
Agreement between COC and sample labels?	Y	
Comments		
If samples were shipped was there an air bi	ll #? Y FedEx 843094805995	, ,
Sample Custodian Signature/Date	mjb 10/23/03 Matent B	74-10/33/0Z

Severn Trent Laboratories, Inc.Chain of Custody Form



02610

•53 Southampton Road Westfield, MA 01085 (P) 413-572-4000 (F) 413-572-3707 stl-westfield •149 Rangeway Road N. Billerica, MA 01862 (P) 978-667-1400 (F) 978-667-7871 STL-BILLERICA

Client: Geomega /Ohn Corp	Project #:	: 302A/C03	Job# 2 16972 Quote#	P ⊙#
Address: 3995 Baseline Rd Ste 202	_ Project Manager:	Dan Stone	Shaded areas for office use Analysis Requested	Comments
Boulder CO 80303	Work ID:		Check analysis and specify method	(Special Instructions)
Phone: 3034439117 Fax: 303 9388123			and analytes in comments section. For example:	
Requested Turn Around Time 10 Business Day (Std) Rush TAT Requested:	NPDES Drink	ation / Special Report Format king Water DEP Form(s)	500-series for drinking water 600-series for waste water	Analyte list
15 Business Day 24 hrs 72 hrs	RCRA MCP	GW1/S1 — MWRA Smart Rpt	8000-series for haz/solld waste Use comments section to further define.	
Other 48 hrs 5 Day Sample Type Codes WW-Wastewater DW-Drinking water SW-Surfacewater W-Labwater GW-Groundwater A-Air S-Solid / Soil SL-Sludge O-Oil Z-Other	Other	or Glass(G) WMeOH PH < 2 O PH < 2 O PH < 2 O PH < 2 O PH < 2 O PH < 2 O PH < 2 O PH < 3 O PH < 3 O PH < 3 O PH < 3 O PH < 3 O PH < 3 O PH < 4 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH < 5 O PH	270 titicides H D O / 200.7 emistry cal	EPA mother 200.7
Samble ID Sample Sample ID	Date Time	# Containers Plastic(P) or Glass(NaHSO4/MeOH HNO3 to pH <2 HCI to pH <2 HCI to pH <2 NaOH to pH >12 NaUSS2O3 Nau2S2O3 None / 4° C Volatiles 524/67 Volatiles 8260/8 Semivoa 625	Semivoa 8270 PCB / Pesticides EPH / VPH DRO / GRO Metals 6010 / 200 General Chemistry Bacteriological Toxicity Oil & Grease / TOC	Chromium total Chromium Trivalent
11-7	Collected 5 8		S C C C C C C C C C C C C C C C C C C C	
WF3 W @	1300	1		Aluminum
WF4 W	1315	1 1		Iron
WF5 W	1330			Manganese
WF7 W/	1350	1 8		· ·
WF8 W	10/22/03	18		EPA method 7196d
White floc S	1430	1 1		Hexavalent Chronium
				& All water Samples
			11/2/0/12/0	filtered to 0.1 micron
Sampled by (print): Craig R Walker	10/22/03 1500	Signature:	1 1 1 9 7 1 1 1 1 1	Cooler 7 (₹ 1) N. Samples Iced? (₹ 1) N
Relinquished by: Date	: Time:	Received by:	Date:/ Time:	Temp:@recalpti <u>ful</u> ºC
Relinquished by: Date	: Time:	Received by:	Date: Time:	Preservation/pH shecked
Method of shipment:		STL-Westfield		By: 700 Date: (p) 1303